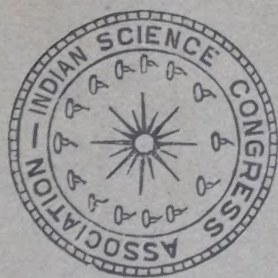


PROCEEDINGS OF THE 35TH INDIAN
SCIENCE CONGRESS-PATNA-1948
PART-III-ABSTRACTS

Proceedings
of the
Thirty-Fifth
Indian Science Congress

PATNA, 1948

PART III
ABSTRACTS



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Proceedings of the Thirty-fifth Indian Science Congress

PART III—ABSTRACTS

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35TH INDIAN SCIENCE CONGRESS, PATNA, 1948

SECTION OF CHEMISTRY

PRESIDENT: DR. B. SANJIVA RAO, M.A., PH.D.
SC. (LOND.), F.N.I.

ABSTRACTS

Inorganic Chemistry

1. Nature of chemical bond—Part I. Ionic character and nuclear charges.

S. K. K. JATKAR and S. N. GOPALASWAMY (Bangalore)

In the discussion of the ionic character of the chemical bond, the dipole moments of the hydrogen halide molecules have played an important part. The dipole moments of HI, HBr and HCl have been used as the basis of several complex and empirical relationships between the electronegativity and ionic character. It has been found that the ionic character of a bond A-B is simply given by $\left(\frac{Z_A}{Z_A + Z_B} \right)^W$ where Z_A is the nuclear charge of the hydrogen atom and Z_B the nuclear charge of the other atom and n has the values of 6, 5, 3, 2 and 1, etc.

2. Nature of chemical bond—Part II. Bond energy and ionic character.

S. K. K. JATKAR and (Miss) S. B. KULKARNI (Bangalore)

Although the *partial* ionic character of a chemical has been the accepted basis of the nature of the Chemical Bond, the energy due to *extra* ionic nature, has been erroneously calculated by Pauling by postulating a resonance between covalent and ionic structure even in diatomic molecules and a set of electronegativity tables have been constructed which have recently been improved upon by Rice, Gordy and others. It has been found that if the *partial* covalent bond energy is taken into account the balance of the binding energy is equal to e^2/γ times the ionic character where e^2/γ is the Coulomb energy. The covalent bond energy can also be calculated by the equation of the type

$\frac{1}{\sqrt{n(n+2)}} \times \frac{e^2}{\gamma}$ where $\sqrt{n(n+2)}$ is the spin factor of the valence electrons.

3. The dielectric constant and the dipole moment of mercurous chloride and vanadium pentoxide.

S. K. K. JATKAR and S. N. GOPALASWAMY (Bangalore)

The dielectric constant of mercurous chloride as determined by the temperature method is found to agree very well with that measured by the mixture method for solids. The dipole moment as calculated by the new equation is 1.56D, while mercuric chloride in dioxane solution gives moment

of 1.14. The ionic character of the bonds in these two chlorides as well as in mercuric bromide and mercuric iodide has been compared and discussed in the light of the nuclear charges of the bonded atoms. The dielectric constant of mercurous chloride shows a tendency to decrease with increasing temperature (11.65 at 30° C. and 11.40 at 70° C.). Vanadium pentoxide has a dielectric constant of about 27 at 30°.

4. The electric Curie temperature.

S. K. K. JATKAR and B. R. Y. IYENGAR (Bangalore)

Analogous to the introduction of a Curie temperature in paramagnetics, the ferroelectric substances like rochelle salt and titanates show a characteristic temperature θ . Thus the most general equation, derived previously connecting the dielectric constant and dipole moment now becomes $(\epsilon - n^2) \frac{M}{d} = \frac{4\pi N\mu^2}{3K(T - \theta)} \frac{(j + 1)}{j}$. As in paramagnetism the characteristic temperature is attributed to a "molecular field effect". For a dipolar molecule, θ signifies the temperature above which it has sufficient energy to orientate in an electric field. The introduction of θ , successfully explains the temperature coefficients of the dielectric constants of a number of polar liquids and solids. The studies reveal that in associated compounds $\theta \approx \text{M.P.}$, and in crystalline solids $\theta = \text{transition temperature}$. As in the magnetic case, for a polar substance dissolved in a normal or non polar liquid (i.e., $\theta = 0$) θ gradually diminishes with dilution to zero.

5. Dielectric constant of titanates, rochelle salt, etc.

S. K. K. JATKAR and B. R. Y. IYENGAR (Bangalore)

The introduction of a characteristic temperature corresponding to the observed temperature of transition from a low, to a peak value of dielectric constant quantitatively accounts for the dielectric constant and its temperature coefficients, of ferroelectric substances like rochelle salt, barium titanate, etc.

The moments (μ) calculated by the equation $(\epsilon - n^2) \frac{M}{d} = \frac{4\pi N\mu^2}{K(T - \theta)}$ are invariant with temperature and their magnitude is conclusive of the fact that the molecules in the lattice are associated with definite and characteristic dipole moments arising out of their orientation, in an electric field. For rochelle salt the moment obtained by applying the equations implicitly to both the observed Curie points (-15° and 22°) is the same (2.5D) while in TiO_2 and BaOTiO_2 the moments calculated for the high transition is the co-ordination number times the moment at the lower transition. The same is true of silica.

6. Reactions of Hyponitrites—Part III. Estimation of hyponitrite, nitrite and nitrate in presence of each other.

T. M. OZA and N. L. DIPALI (Ahmedabad and Dharwar)

The behaviour of sodium hyponitrite alone and in admixture with sodium nitrite, in the solid state and in solution, to several reagents has been investigated. It is found that (i) sodium hyponitrite behaves like sodium carbonate in titrations with standard mineral acids at and about 0° C. the two distinct stages being manifested, one with phenolphthalein and the other with methyl orange as indicator; the first stage corresponding with the hydrohyponitrite stage; (ii) carbon dioxide converts solid sodium hyponitrite, quantitatively, into sodium carbonate so that sodium nitrite in admixture with sodium hyponitrite can be estimated by the usual methods after converting the sodium hyponitrite into sodium carbonate; (iii) sodium hyponitrite in solution almost completely decomposed on boiling the solution without forming any nitrite or nitrate so that a solution containing the two salts lends itself to the usual methods of estimating its nitrite content after

boiling; (iv) silver nitrite is much more soluble than silver hyponitrite and the former can be removed from its admixture with the latter from a freshly made precipitate of the two without very seriously impairing the amount of the latter. The silver hyponitrite left may then be dissolved out in dil. HNO_3 and titrated with standard sulphocyanide using ferric alum as indicator (Oza and Walawalkar, *J. Ind. Chem. Soc., Ind. and News Edition*, 1946, 9, 57).

Nitrate in admixture with nitrite and hyponitrite can be estimated by destroying the hyponitrite either by boiling or by treatment with sulphuric acid of appropriate strength [Oza, Dipali and Walawalkar, *J. Univ. Bom.*, 1945, 14, (3), 27].

7. Preparation of Nitrites of alkali and alkaline earth metals.

T. M. OZA and N. L. DIPALI (Ahmedabad and Dharwar)

The method of preparing nitrite of a metal by double decomposition between silver nitrite and chloride of the metal has been rendered convenient by carrying out the reaction in a strongly ammoniacal solution in which silver nitrite dissolves freely. As no evaporation of a large bulk of the solution is required for recovering the nitrite from the solution, the nitrite obtained is quite pure and contains not even a trace of nitrate as impurity.

8. The thermal Decomposition of Magnesium nitrite.

T. M. OZA and N. L. DIPALI (Ahmedabad and Dharwar)

Pure magnesium nitrite has been prepared and its thermal decomposition studied with a view to throw light on the mechanism of the reactions occurring and compare them with those occurring in the decomposition of alkali nitrites. A quantitative study has been made of the gaseous products and the solid residue left when the reactions are carried out with (i) same mass heated for the same period of time at varying temperatures; (ii) varying masses heated for the same period of time at a constant temperature and; (iii) same mass heated at a constant temperature for varying periods of time.

Magnesium nitrite has been selected for the study to avoid, as far as possible, the complications brought about by reactions depending upon high temperature, as magnesium nitrite is known to decompose at comparatively low temperatures. It has been found that temperature is the controlling factor in deciding which of the two equations assigned by Ray and Ganguli applies. It has also been found that, in any case, the reactions proceed in stages and the equations of Ray and Ganguli are but the net result of the four simultaneously occurring reactions found by Oza (*J. Ind. Chem. Soc.*, 1945, 22, 173) and Oza and Walawalkar (*J. Ind. Chem. Soc.*, 1945, 22, 243) taking place in the decomposition of alkali nitrites.

9. Electro-chemical preparation of Sodium hydrosulphite.

C. C. PATEL, J. C. GHOSH and M. R. A. RAO (Bangalore)

Sodium bisulphite solution has been subjected to electrolytic reduction in an inert atmosphere using a mercury cathode and a platinum anode. The anolyte consists of a saturated solution of sodium bicarbonate separated from the catholyte by a porous pot diaphragm. Employing a concentrated solution of sodium bisulphite (30%) at 8° C. - 10° C., a maximum concentration of 10.6% of hydrosulphite has been obtained with an average current efficiency of 70% (C.D. 2.6 amps./sq.d.m.). The concentration of the hydrosulphite cannot be increased further, due to the formation of thiosulphate. Maintenance of a low temperature (8° C. to 10° C.) and a suitable pH range of the catholyte (between 5 and 6) helps hydrosulphite production. Sodium silicate and formaldehyde retard the production of hydrosulphite, while nical BX has no effect. A small quantity of zinc in mercury promotes the formation of hydrosulphite.

10. Estimation of Sodium hydrosulphite in presence of Sodium bisulphite.

C. C. PATEL and M. R. A. RAO (Bangalore)

The influence of sodium bisulphite on the estimation of sodium hydrosulphite was investigated employing the following four methods of analysis:

- (i) Potassium ferricyanide method (both colorometrically and potentiometrically),
- (ii) Indigo carmine method,
- (iii) Ammoniacal copper sulphate method, and
- (iv) Ammoniacal silver nitrate method (potentiometrically).

The increase in the analytical values of hydrosulphite when it is contaminated with sodium bisulphite, amounts to more than 50% in the first two methods while in the latter two, it amounts to about 10%, depending on the amount of the bisulphite present. However, when bisulphite is absent, the ferricyanide method is to be preferred on account of its simplicity, while the cuproammonium sulphate method can be adopted in presence of bisulphite as readings can easily be taken. In the latter case, a correction factor has to be applied, which depends on the amount of bisulphite present.

11. Preparation of Sodium hydrosulphite by the reduction of Sodium bisulphite with Sodium amalgam.

C. C. PATEL and M. R. A. RAO (Bangalore)

Sodium hydrosulphite has been prepared by the reduction of sodium bisulphite by sodium amalgam in an inert atmosphere. The formation of hydrosulphite is maximum when the temperature is maintained at 30° C. and the pH of the bisulphite solution is kept between 5 and 6. The percentage of hydrosulphite increases with the diminution of sodium content in the amalgam and the use of high concentrations of bisulphite (10%–20%). The maximum efficiency of reduction (on the basis of sodium in the amalgam) happens to be 66% when the reduction of a 10% solution of bisulphite having a pH of 5.3 is carried out at 30° C., employing a concentration of 0.03% sodium in the amalgam.

12. Kinetics of the gaseous reaction between hydrogen sulphide and sulphur dioxide in presence of catalysts.

B. SANJIVA RAO and A. R. VASUDEVA MURTHY (Bangalore)

Certain sulphides, in presence of a small amount of moisture, catalyse the reaction between hydrogen sulphide and sulphur dioxide (*cf.* B. S. Rao, *Curr. Sci.*, 1943, **12**, 323). The kinetics of this reaction was studied in a closed system using an all-glass circulation pump. The partial pressure of water in the reaction system was maintained constant with the aid of suitable hygrometers. The reaction was bimolecular. The higher the partial pressure of water in the reaction mixture, the greater was the velocity of reaction for a given catalyst. Of the sulphides employed, cobalt thiomolybdate was found to be the best catalyst. Cobalt sulphide and molybdenum sulphide were less efficient. Next in order of efficiency was silver sulphide. The mechanism of the reaction is explained on the basis of formation of thiosulphurous acid as the primary product.

13. Catalytic Decomposition of Hydrogen Persulphide Vapour by Silver Sulphide.

A. R. VASUDEVA MURTHY and B. SANJIVA RAO (Bangalore)

Silver sulphide is known to catalyse the reaction between (a) hydrogen sulphide and sulphur dioxide and (b) hydrogen sulphide and sulphur monoxide

(and its dimer) (B. S. Rao, *Curr. Sci.*, 1943, **12**, 322; B. S. Rao and M. R. A. Rao, *ibid.*, 1943, **12**, 323). It has been found that silver sulphide also catalyses the decomposition of hydrogen persulphide vapour. The significance of this catalytic reaction is discussed in relation to the catalytic effect of the sulphide on the reaction between hydrogen sulphide and sulphur dioxide.

14. Reaction between Hydrogen Sulphide and Chloramine-T in Aqueous Solution.

B. SANJIVA RAO and A. R. VASUDEVA MURTHY (Bangalore)

When hydrogen sulphide is oxidised by chloramine-T in aqueous solution, part of the sulphide is oxidised to sulphur (Reaction A) and the rest to sulphate (Reaction B). The relative proportion of these two products of oxidation depends on the pH of the solution and the presence of certain catalysts. In highly acid solutions the hydrogen sulphide is completely oxidised to sulphate. At pH 0.65, B/A is 16.6; at pH 4.7, 8.6; at pH 7, 1.6; at pH 9.2, 0.83; and at pH 12, 0.02. Molybdic acid catalyses the oxidation to sulphate, while brucine, osmic acid and tungstic acid retard such oxidation. The results are explained on the basis that hydrogen sulfoxide is the primary product of oxidation of hydrogen sulphide and undergoes two simultaneous reactions:—(a) decomposition into water and sulphur, and (b) oxidation to sulphate.

15. The Influence of pH on the Oxidation of Hydrogen Sulphide by Potassium Iodate.

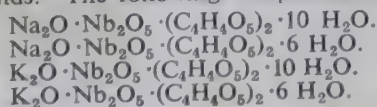
A. R. VASUDEVA MURTHY and B. SANJIVA RAO (Bangalore)

The oxidation of hydrogen sulphide by potassium iodate was studied in buffer solutions, varying in pH from 7 to 12. Part of the hydrogen sulphide is oxidised to sulphur (Reaction A) and the rest to sulphate (Reaction B). At pH 7, B/A is 2, but the addition of a little potassium iodide, lowers the value to 0.25. With an increase in pH, the production of sulphate is considerably reduced, B/A dropping to 0.33 at pH 11.7. Molybdic acid which catalysed the oxidation of hydrogen sulphide to sulphate by chloramine-T, diminished sulphate production in the case of iodate. Brucine and osmic acid had the same effect as in the case of chloramine-T—they diminished sulphate production. The mechanism of the oxidation is discussed.

16. Niobotartrates.

N. R. SRINIVASAN (Bangalore)

The complex compounds of Niobium with organic acids have been investigated. It has been found that tartaric acid dissolves freshly precipitated niobic acid resulting in the formation of a Metaniobotartaric acid (Srinivasan, *Curr. Sci.*, 1947, **16**, 60). Some alkali niobotartrates have been prepared. Sodium and potassium niobotartrates have been prepared by reacting definite alkali niobates with calculated amounts of tartaric acid and crystallising them from water or with the addition of alcohol. They are obtained as white compounds with crystalline lustre. Their aqueous solutions are hydrolysed by mineral acids with the precipitation of niobic acid, whereas alkalies and ammonia do not cause any precipitation. A suitable method of analysis has been devised to determine the stoichiometric composition of the complex compounds. The following compounds have been isolated:



Physico-chemical measurements have been made with a view to elucidate their structure.

17. Studies on the formation of the complex compounds of potassium chloride and mercuric chloride—Part V.

L. N. SRIVASTAVA (Lucknow)

Further evidence from the e.m.f. measurements has been adduced in support of the formation of complex compounds in a mixture of potassium chloride and mercuric chloride solutions as reported earlier (*Proc. Ind. Sci. Congress*, 1947). The breaks in the curve correspond exactly with those obtained in the graphs for other physico-chemical properties, e.g., density, viscosity and conductivity, etc.

18. Two Modifications of Copper N-Diethylbiguanide.

PRIYADARANJAN RÂY and NRIPENDRA NATH GHOSH (Calcutta)

Two varieties of copper N-diethylbiguanide, red and blue-violet, have been prepared, besides a number of salts of the complex base, viz., chloride, hydroxo-chloride, bromide, iodide, sulphate and nitrate. From a study of the properties and reactions of the two modifications of the base, they have been represented as cis-trans isomers of a planar penetration complex with dsp^2 hybrid bonds. Among the salts of the base, only the chloride has been found to give some indication of occurring in two forms, which, however, could not be isolated in the pure state.

19. The Semi-polar Single Bond—Part I.

S. S. AHMAD (Aligarh)

Existing anomalies in the electronic theory of valency are discussed. An attempt is made to explain these anomalies on the basis of the semi-polar single bond mentioned earlier by Ingold.

20. The Semi-polar Single Bond—Part II. Boron Hydrides.

S. S. AHMAD AND S. M. ALI NAQVI (Aligarh)

Various hypotheses put forward to explain the electronic structure of the boron hydrides are examined. An attempt is made to explain the structure on the basis of the concept of the semi-polar single bond. The configuration of the molecule of diborane is theoretically deduced.

Physical Chemistry

21. Formation of complex compounds between lead nitrate and alkali nitrates—Part IV.

M. R. NAYAR and C. S. PANDE (Lucknow)

In this paper we describe the results obtained with two systems:

- (1) *Lead nitrate-sodium nitrate-water*: where there is no indication of formation of any complex compound, and
- (2) *Silver nitrate-potassium nitrate-water*: in which a complex compound is definitely known to be produced.

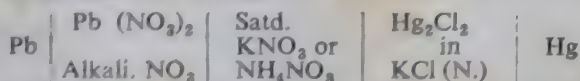
The physico-chemical properties studied in the first system were viscosity and conductivity, and in the other system were viscosity and E.M.F. In the sodium nitrate system, when these different values are plotted against the concentration of lead nitrate, all the plots are regular, indicating that the tendency for complex formation is practically nil, while in the $AgNO_3$ system there is one break at which the molecular ratio between KNO_3 and $AgNO_3$ follows the stoichiometric relation and corresponds to the compound $KNO_3 \cdot AgNO_3$.

The differences in the results obtained with the two systems examined enable us to say definitely that the methods of procedure followed by us are such as to reveal the formation or otherwise of complex compounds in solution, and that in the case of positive results, the formula of the compound produced can be directly read from the graph.

22. Formation of complex compounds between lead nitrate and alkali nitrates—Part V. E.M.F. Measurements.

M. R. NAYAR and C. S. PANDE (Lucknow)

In continuation of the previous work (Nayar and Pande, *Ind. Sci. Cong. Abst.*, 1947, 19, 4), we have now sought to obtain additional evidence for the formation of complex compounds from E.M.F. measurements. The two systems: $\text{KNO}_3\text{-Pb}(\text{NO}_3)_2\text{-H}_2\text{O}$ and $\text{NH}_4\text{NO}_3\text{-Pb}(\text{NO}_3)_2\text{-H}_2\text{O}$ were studied. A set of 25 solutions was prepared in which the concentration of alkali nitrate was kept constant, viz., (1/3 M.), while that of lead nitrate varied systematically from 0.0 M. to 2/3 M. E.M.F. measurements were made by using the following type of cells.



For purposes of comparison, the values obtained with lead nitrate alone, in the absence of alkali nitrates were also determined. When the E.M.F. values are plotted against the concentration of lead nitrate, three breaks are obtained in each of the two systems. The molecular ratios between the concentration of the constituents at these points correspond to three complexes as noticed before, viz., (a) $4\text{KNO}_3\text{-Pb}(\text{NO}_3)_2$, (b) $2\text{KNO}_3\text{-Pb}(\text{NO}_3)_2$, and (c) $\text{KNO}_3\text{-Pb}(\text{NO}_3)_2$ in the system: $\text{KNO}_3\text{-Pb}(\text{NO}_3)_2\text{-H}_2\text{O}$, and (a) $4\text{NH}_4\text{NO}_3\text{-Pb}(\text{NO}_3)_2$, (b) $2\text{NH}_4\text{NO}_3\text{-Pb}(\text{NO}_3)_2$ and (c) $\text{NH}_4\text{NO}_3\text{-Pb}(\text{NO}_3)_2$ in the system: $\text{NH}_4\text{NO}_3\text{-Pb}(\text{NO}_3)_2\text{-H}_2\text{O}$.

23. Formation of complex compounds between lead nitrate and alkali nitrates—Part VI (Transport number measurements).

M. R. NAYAR and C. S. PANDE (Lucknow)

In the earlier parts of this series enough experimental evidence has been adduced to indicate the probable existence of three compounds in each of the two systems: $\text{KNO}_3\text{-Pb}(\text{NO}_3)_2\text{-H}_2\text{O}$ and $\text{NH}_4\text{NO}_3\text{-Pb}(\text{NO}_3)_2\text{-H}_2\text{O}$. Attempts to isolate these compounds in the solid state failed, as they resulted in their decomposition into the constituent salts on crystallisation. Then the alternative was to investigate them while the substances were still in solution. The centre of interest was Pb ion, and in order to have a more quantitative idea of its behaviour the transport number of the ion was studied in lead nitrate solution under different conditions, i.e., in the presence and absence of alkali nitrate. For purposes of comparison we record similar values obtained for Ag ion in the well-known system: $\text{KNO}_3\text{-AgNO}_3\text{-H}_2\text{O}$.

The results obtained with the experiments on transport number indicate:—

- (1) significant variation in the values for Pb ion in presence of KNO_3 or NH_4NO_3 ;
- (2) three different orders of magnitude in the values corresponding to the three different complexes assumed to exist in solution, while
- (3) the values for Ag ion in presence of KNO_3 shows a very sharp change for a ratio of molecular concentrations 1 : 1, but no significant change for any further increase in the concn. of alkali nitrate, signifying that we are dealing with only one complex compound; and on the other hand,

- (4) sodium nitrate affects the transport number of Pb ion to some extent showing a slight tendency for the formation of complexes, but no stoichiometric relations have been observed.

24. Dissolution of mercury in nitric acid—A kinetic study.

A. N. KAPPANNA and K. M. JOSHI (Nagpur)

The rate of dissolution of mercury in nitric acid has been studied. The rate depends upon the conditions of experiment. When the nitric acid is kept stirred and mercury added to it, it is found that there is no reaction at all for a while. This period of no-reaction (i) diminishes with increase in concentration of nitric acid and (2) increases with the rate of stirring when concentration of acid is kept constant. It has been found that the addition of nitrous acid initially to nitric acid diminishes this period of inertia, while mercurous ion exerts no influence.

25. Redox Potentials of Chloramine-T: Sulphonamide Systems.

A. R. VASUDEVA MURTHY and B. SANJIVA RAO (Bangalore)

The redox potentials of chloramine-T, sulphonamide systems have been measured in presence of suitable buffers. It is found that the potential diminishes as the pH rises. The fall in potential has been correlated with the increase in solubility of the sulphonamide, consequent on the rise in pH.

26. The ternary system silver oxide—Periodic acid—Water at 35° C.

P. B. GANGULY and P. P. GYANI (Patna)

The ternary system Ag_2O —Periodic acid— H_2O has been studied at 35° C. Two solid phases of compositions $5 \text{Ag}_2\text{O} \cdot \text{I}_2\text{O}_7$ and $2 \text{Ag}_2\text{O} \cdot \text{I}_2\text{O}_7 \cdot \text{H}_2\text{O}$ have been shown to exist. They have also been isolated in the pure state and their composition studied. The compound $2 \text{Ag}_2\text{O} \cdot \text{I}_2\text{O}_7 \cdot \text{H}_2\text{O}$ is stable only in presence of excess of periodic acid and is decomposed by pure water with the separation of the compound $5 \text{Ag}_2\text{O} \cdot \text{I}_2\text{O}_7$.

27. The surface properties of rubber hydrocarbon.

N. H. SIVARAMAKRISHNAN, M. R. A. RAO and J. C. GHOSH
(Bangalore)

Rubber hydrocarbon has been purified by (1) fractional precipitation making use of solutions of crepe rubber in benzene, using alcohol as the precipitant, (2) alkali purification of ammoniated latex and (3) autoclave purification of the ammoniated latex. The purified samples of the rubber hydrocarbon were dissolved in benzene, chloroform, and carbon tetrachloride and the spreading property of the rubber hydrocarbon studied by employing the Langmuir-Adam trough technique. Stable films of rubber hydrocarbon were obtained with benzene and chloroform solutions while with carbon tetrachloride the films were not stable.

It has been found that for a given liquid, the dilution of the rubber solution increases the spreading power giving a limiting value at high dilutions. The limiting value for the thickness of the film for a given sample of rubber is also a function of the nature of the solvent employed. Chloroform solutions give rubber films which are half as thick as those from the benzene solutions (700 Å). The rubber hydrocarbon when spread over aqueous potassium permanganate, shows an increase in area with time. When a sample of chlorinated rubber is employed for spreading, it is observed that the thickness of this film is about one-tenth (70 Å) of that observed with pure rubber hydrocarbon.

28. Kinetics of hydrolysis of *d*-malolactonic acid.

J. C. GHOSH and M. S. MUTHANNA (Bangalore)

The kinetics of the hydrolysis of *d*-malolactonic acid in acid and in alkaline media and the effect of silver oxide on the hydrolysis of the lactonic acid and its rotational changes, have been studied. Dilute acid hydrolysis of the lactonic acid is comparatively slow and follows a bimolecular course leading to the formation of l-malic acid, while alkaline hydrolysis is monomolecular, the malic acid formed retaining the configuration of the lactone. Hydrolysis with silver oxide of varying concentrations gives malic acid of the same sign of rotation as the lactone, contrary to its action on l-bromo-succinic acid where different concentrations of silver oxide produce malic acid having different and even opposite sign of rotation with respect to l-bromo-succinic acid.

Kinetics of the hydrolysis of bromo-succinic acid with various bases has been studied at different hydrogen-ion concentrations. The results are as follows:

- (1) At a given pH the monomolecular velocity constant (1.2×10^{-3}) remains constant.
- (2) Monomolecular velocity constant increases linearly with an increase in pH.
- (3) For pH not exceeding 9.6, the hydrolysis of bromo-succinic acid leads predominantly to the formation of malolactonic acid.

29. Influence of gases on the contact angle at mineral surfaces.

R. VENKATADAS, J. C. GHOSH and M. R. A. RAO (Bangalore)

It is generally believed that the nature of a gas has no effect on the contact angle at polished mineral surfaces. Investigations carried out in this laboratory show that the contact angle in some cases is a function of the gas also. Determination of the contact angle by the projection microscopic method indicated that the calcite surface gave a zero contact angle both with air and with carbon dioxide when the mineral was immersed under distilled water. When the mineral surface however, was allowed to remain in contact with a mixture of sodium oleate (0.02%) and sodium carbonate (0.01%) the contact angle with air was 0° while with carbon dioxide it was 90° . Similar experiments with Whitherite, Strontionite, Siderite and Cerussite showed a definite difference (over 40°) between the contact angles with air and with carbon dioxide when the minerals were treated with a mixture of sodium oleate and sodium carbonate. Similarly with sulphide minerals a difference in contact angle was observed between air and hydrogen sulphide in presence of a mixture of sodium ethyl xanthate and sodium hydroxide.

30. Nickel—Thoria—Kieselguhr (100 : 18 : 100) Catalyst for the Fischer-Tropsch Reaction.

J. C. GHOSH, N. G. BASAK and G. N. BADAMI (Bangalore)

The Nickel—Thoria—Kieselguhr (100 : 18 : 100) catalyst, developed in this laboratory, can be used industrially under certain conditions.

The catalyst is prepared by precipitation of the two carbonates (from nitrates) by ammonium carbonate in presence of carbon dioxide in excess. The catalyst on filtration is dried at 110°C . and then reduced at 500°C . in a current of pure hydrogen (electrolytic).

The catalyst thus prepared, yields at 195°C . and at atmospheric pressure 147.5 gm. of liquid and gaseous hydrocarbons (excluding methane) per cubic metre of synthesis gas ($\text{CO} : \text{H}_2$ as 1 : 2) with a space velocity of 196.6 c.c. of gas per c.c. of catalyst per hour which compares well with that used in industrial practice.

31. Symmetry values of clay salts of silicate minerals.

S. K. MUKHERJEE and A. GANGULI (Calcutta)

Symmetry values of a number of colloidal salts prepared from the clay fraction of montmorillonite, mica, illite, and asbestos have been determined against various electrolytes. The orders of the replacement of cations follow in general the lyotrope series with several marked discrepancies. In this respect the behaviour of K^+ ion in the mica systems is interesting. It is held fast against added Ba^{++} and Ca^{++} which are highly adsorbable, and conversely also it displaces these cations easily from their mica salts. The crystal lattice of mica in which K^+ ion fits in well as an integral constituent is probably responsible for this behaviour of K^+ ion. The few determinations of symmetry values with the colloidal salts of asbestos, which have not been hitherto studied from this point of view, show that the cation exchange is similar to that of other minerals. Occasional departures from the lyotrope series have been observed in bentonites and illites and the effect of pH is being investigated.

32. Conditions of equilibrium in cation and anion exchange resins.

S. K. MUKHERJEE and S. L. GUPTA (Calcutta)

Ion exchange reactions with a cation exchanger (resorcinol-formaldehyde condensation product) and an anion exchanger (*m*-phenylene diamine-formaldehyde condensation product) have been studied to determine the mechanism underlying them. The cation exchange resin showed at first a highly variable exchange capacity which was measured by leaching with $N-BaAc_2$ and $N-AmAc$ solutions according to the methods of Parker and Schollenberger applicable to soils and clays. On prolonged treatment with salt and acid solutions the exchange capacity gradually attained a high and almost constant value. It is likely that the process of condensation did not attain equilibrium under the conditions of its preparation. The anion exchange resin was prepared under more favourable conditions and it was observed that the exchange capacity of this resin determined by estimating the amount of $SO_4 =$ ion adsorbed from a sulphuric acid solution was more or less constant. In both the resins, however, the attainment of equilibrium requires a long time of contact (10 to 30 days) with the leaching solutions and the exchange is stoichiometric.

33. Nature of the exchangeable Hydrogen in Clay Minerals as revealed by Moisture Data.

S. K. MUKHERJEE and A. GANGULI (Calcutta)

Electrochemical studies of the interaction between hydrogen clays and clay minerals and electrolytes have demonstrated the different levels of reactivity of hydrogen ions present in an exchangeable form in the double layer of the colloidal particles. From the loss of moisture on ignition from oven-dry samples of hydrogen mica, hydrogen kaolinite and hydrogen bentonite when compared with loss of moisture under similar conditions from original samples (not converted into the hydrogen systems) it appears likely that the hydrogen ion is present in its hydrated form, *i.e.*, H_3O^+ and not as H^+ . Taking for example, the mica system, the hydrogen mica will lose more moisture than the original sample due to the exchangeable hydrogen, the amount of which is known from the value of the base exchange capacity. The theoretical moisture loss from hydrogen mica can be calculated and is in close agreement with the observed value, if the hydrogen ion is assumed to be present as H_3O^+ ; whereas, if hydrogen ion is assumed to be present as H^+ , the theoretical value is much less than the observed one. Since montmorillonite has a variable structure the calculations have been made in a different way. The "molecular weight" of the mineral has been calculated from moisture data, and compared with the accepted values. The agreement

is much closer when it is assumed that the exchangeable hydrogen ion is present as H_3O^+ .

34. Catalytic cracking of kerosine oil.

U. SANJIV and S. S. GHOSH (Bangalore)

Experiments on catalytic cracking of commercial fuel-oils, such as kerosine oil, were conducted on a laboratory scale with a view to study the economic possibilities of replacing the thermal cracking plant by a suitable catalytic cracking unit for supplying laboratory gas. The common Houdry type cracking catalysts were used. Three catalysts were used: (1) Fullers earth, (2) precipitated alumina and silica, and (3) Alumina and silica precipitated on Fullers earth. At $600^\circ C.$, the best yield was obtained with catalyst (3). The gas had a high percentage of unsaturated hydrocarbons. Methane and hydrogen were also present in good amounts. The nature of the reactions is discussed.

35. Production of the *Joshi-Effect* in Oxygen under Ultra-Violet.

S. R. MOHANTY (Benares)

Joshi-effect Δi has been studied in oxygen under the ultra-violet. Purified oxygen was enclosed at 250 mm. in a Siemens' tube provided with a quartz window at one end. It was excited at different V in the range 2-5 kV of 50 cycles frequency, and irradiated in the end-on position, through the quartz window, with a quartz mercury vapour lamp and a 200 volt, 200 watt incandescent (glass) bulb. The effect is greater with the mercury lamp than with the (glass) bulb. When the short waves from the mercury lamp were cut off by the addition of glass plates over the quartz, Δi was reduced to a value sensibly similar to that obtained with the (glass) bulb. Thus *e.g.*, at 2.67 kV, the relative effect % Δi was 29 with the mercury lamp, 19 when the ultra-violet was cut off as indicated above, and 17 with the (glass) bulb. Since with a strong radiation, fluctuations in light-intensity do not alter appreciably Δi , the relatively high values for % Δi with the mercury lamp is attributable to the high frequencies in the radiations.

36. Variation with Applied Potential and Gas Pressure of *Joshi-Effect* in Oxygen under Semi-ozoniser excitation.

S. R. MOHANTY (Benares)

Previous work on *Joshi-effect* in gases referred to excitation in Siemens' tubes. The effect has now been observed in oxygen excited in wire-in-cylinder type of discharge tubes or semi-ozonisers.

A semi-ozoniser with a central high tension wire of platinum was filled with oxygen in the pressure range 10-450 mm. Hg and excited at different V varied over 0.5-3.0 kV of 50 cycles frequency. The current indicator was a reflection galvanometer actuated by a vacuo-junction.

The 'threshold potential' V_m is sensibly a linear function of the gas pressure p ; this also applies to results in Siemens' tubes. No effect is observed below V_m . Above V_m , the net effect Δi increases with V to a maximum and then decreases. Thus *e.g.*, at 150 mm., Δi was 1.00 at 0.93 kV and increased to a maximum of 2.66 at 1.87 kV; further rise in V to 2.67 kV decreased Δi to 2.45. The relative effect % Δi is maximum near V_m and decreases at higher V. Thus, at the above pressure, the maximum % Δi was 50 at 0.93 kV and decreased to 15 at 2.67 kV.

At constant i_D , the effect Δi increases with p to a maximum and then decreases. Thus, for example, at $i_D = 7$, % Δi increased from 9 at 50 mm. to 25 at 200 mm., and decreased to 21 at 450 mm. The variation with p of Δi in oxygen in Siemens' tubes is similar (Mohanty and Kamath, *Phys. Sec. Abst.*, 1947, 15).

37. Influence of the Wall-material on the Potential Reversal of the *Joshi-Effect* in the High Frequency (H.F.), Low Frequency (L.F.) and total (L.T.) conductivity in Chlorine under Silent Discharge.

B. M. SHUKLA (Benares)

In view of Joshi's 'activated layer' postulate, the study of the remarkable sensitivity of this phenomenon to changes of surface nature, revealed a potential reversal of Δi , from negative to positive and *vice-versa* both in i_{LT} and *iaerial*, with a vacuo-junction as the current detector. Double diode RCA, 6H6 and triode 30 were employed as detectors respectively.

Using both the above detectors, the i_{LT} showed a pronounced $-\Delta i$ as contrasted with the observation of reversal of Δi as a function of applied potential, with the vacuo-junction as the current detector. The observations in *iaerial*, with the triode are similar to those obtained in i_{LT} ; with diode an inversion from $-\Delta i$ to $+\Delta i$ at 9.2 kV, in accordance with the results obtained with the vacuo-junction as the current detector, was observed.

The above results indicate the possible role of H.F. components for the production of $+\Delta i$ also. The use of the diode as bi-phase half-wave detector suggests the simultaneous occurrence of $\pm \Delta i$, one associated with the upper and the other with the lower half of a cycle.

38. Comparative Studies of the *Joshi-Effect* in Iodine with a Diode and other A.C. Detectors.

S. N. TEWARI (Benares)

The marked dependence on the nature of the operative conditions and the current detector employed, of the magnitude of the above phenomenon Δi was emphasised by Joshi (1943, 1945 a). The present work reports its comparative study with a vacuo-junction, crystal detector and 83V double diode used as half wave rectifier. Siemens' ozoniser filled with iodine gas and the walls coated with iodine was excited at 50 cycles frequency in the range 500-1800 V.

The 'threshold potential' V_m was found to be independent of the nature of the detectors used. Positive *Joshi-effect* $+\Delta i$ was invariably observed below V_m . In the inductive coupling of the detector diode the light-effect was 38% of the current in dark. Results obtained with a vacuo-junction and a crystal detector were similar but sensibly smaller in magnitude. In the resistive coupling of the diode $\% \Delta i$ was considerably reduced. The influence of R in suppressing $\% \Delta i$ was also observed with the vacuo-junction. The introduction of R in L. T. circuit of the ozoniser damps the H. F. oscillations considerably which are the chief seat of this phenomenon.

The influence of R was markedly uniform under all conditions of excitation and free from apparently anomalous results observed when this phenomenon is studied, using a triode and a pentode as detectors at large R and V.

39. Production of *Joshi-Effect* in a Siemens' Ozoniser Discharge at Large Chlorine Pressure.

P. MALLIKARJUNAPPA (Benares)

Previous work of Deo and Padmanabhulu, Deo and Urs in these laboratories, revealed that both the net effect Δi and the relative effect $\% \Delta i$ decrease with temperature t . The effect also increases markedly with p , the gas pressure (Joshi and Deo, *Nature*, 1944, 154, 343). The temperature influence on Δi is now studied at much larger gas pressure than used previously, viz., 540 mm. The exciting potential is varied from 1-4 kV of 500 cycles frequency. The 'threshold' potential V_m decreases with t . At a constant V, the discharge current i , Δi , and $\% \Delta i$ increase with t ; the increase of i with t , is marked at large V. For example, at 2 kV, i_d in dark increased from 2.6 at 20° C.

to 3.8 at 85° C. and the net effect Δi , and % Δi were respectively 0.4 and 15 at 20° C., and 1.5 and 40 at 85° C. The above results of the author are at variance with those of Deo and co-workers. The increase of Δi with t is ascribed to the enhanced interaction of the excited gas with the glass walls of the ozoniser. This suggestion is in accord with the observation that the effect, at a given t , is comparatively large when the gas is 'aged' at a higher t .

The influence of light frequency was investigated on Δi , produced at potentials 1.4 kV and also in respect of its variation by ageing; that both Δi and % Δi are in the order: white > violet > green > red.

40. Kinetics of the Time Variation of the *Joshi-Effect* in Chlorine under Silent Discharge.

M. V. RAMANAMURTI (Benares)

The theory of the above effect Δi (Joshi, *Phys. Sec., Abst., 26; Curr. Sci., 1947, 16, 19*) contemplates (i) formation of a boundary layer derived in part from adsorption of ions and excited molecules under the applied fields, when intense enough to break down the gas dielectrically (at V_m); and that (ii) photo-electric emission occurs from this boundary layer, under external irradiation, leading (iii) to the effect Δi (*loc. cit.*). Work in these laboratories has shown that (i) is fundamental not only to the production of the *Joshi-effect* Δi but a number of other phenomena, e.g., 'ageing', and the newly observed periodic effect in N_2O-H_2 interaction. Following Joshi's observation on the pronounced influence on Δi of 'ageing', i.e., a time variation of the discharge current i and other quantities at a constant applied potential V , kinetic studies were made for Δi in *freshly* prepared discharge tubes. Results have been obtained for tubes of different sizes, and excited at various applied fields the gas pressure (adjusted to optimum Δi , by preliminary trials) was fixed at 200 mm. pressure. The current i was observed at regular intervals on a reflection galvanometer actuated by a diode.

The *Joshi-effect* Δi was found to increase progressively and become stationary after about five hours, depending upon the operative conditions. The curves Δi -time show a 'first order' reaction. Since the stages (ii) and (iii) are instantaneous and fully reversible in respect of time and the exciting parameters, the above general result is ascribed to the formation of the boundary layer in (i).

41. Studies on Electrodeposition of Bronze from a Cyanide Bath.

D. SINGH and N. N. S. SIDDHANTA (Benares)

Electrodeposition of bronze from a bath containing the cupro-cyanide stannate, cyanide and hydroxide of sodium was studied with respect to electrolyte concentration, inter-electrode distance, duration of electrolysis, current density, temperature and addition agents. Optimum conditions for a satisfactory deposit on copper with respect to these factors are as follows:—

Electrolyte concentration should be such that the ratio copper to tin is 1 : 3. Otherwise, the deposit does not correspond to bronze in composition.

Inter-electrode distance of 1 cm. to 2 cm. is favourable; at greater distance less tin is deposited, and the deposit is yellowish.

Optimum duration of electrolysis is 15 to 20 minutes. Shorter duration gives a reddish deposit (copper in excess), longer duration resulting in a blackish, less adherent and non-uniform deposit, due presumably to oxidation of copper.

Optimum C.D. is 0.38 amps./dm.² Lower C.D. gave a reddish deposit with high Cu content. Higher C.D. gave a black burnt deposit. Cathode efficiency at optimum C.D. is 62.5%.

Deposition was tried at temperatures ranging from 20° C. to 80° C. The yellowish colour at low temperature changed to bright white at 50° C. to 60° C., but turned black on further rise of temperature.

Use of glycerol 0.5 to 2% gave a yellow deposit. 0.5 to 3% sodium chloride, 0.5 to 1% ammonium chloride, 0.5 to 3% sodium thiosulphate

improved the quality of the deposit. Use of 0.5% to 3% hydrogen peroxide gave most satisfactory results with respect to mechanical strength, uniformity of tint and polish.

42. A Study of some Physico-Chemical Factors in the Electro-deposition of Brass.

D. SINGH and P. C. PRADHAN (Benares)

A detailed study has been made of the optimum conditions for a smooth and adherent deposit of brass over a *base* metal, viz., iron, from a bath containing copper sulphate, zinc sulphate, sodium cyanide and ammonium hydroxide. The influence on the quality of the deposit of the following factors has been studied *inter alia*: (i) bath concentration, (ii) inter-electrode distance, (iii) time, (iv) C.D., (v) temperature, and (vi) addition agents.

At a given C.D., satisfactory deposits are obtained from a solution containing 90 gms./litre of copper sulphate and zinc sulphate in the ratio of copper : zinc :: 4 : 1 within 20–60 minutes, after which the deposit is blackish and non-adherent, due presumably to copper oxidation. The pH of the solution is maintained at 10.5 ± 0.1 and the inter-electrode distance 3 cm. Optimum C.D. is 2–3 amps./sq. ft. Further rise in C.D. makes the deposit spongy and "burnt", due to rapid depletion of metallic ion round the cathode. Low C.D. gives no deposit, probably due to hydrogen discharge. The quality of the deposit improves with an increase in the temperature upto 45°C. At temperatures above 65°C., the deposit becomes black. Use of chlorides of sodium, potassium or ammonium improves the deposit. The presence of ammonium chloride in the bath prevents the precipitation of zinc hydroxide. Organic reagents like acetone, glycerol, ethyl alcohol do not improve the quality of the deposit.

43. Formation of Formaldehyde during the Interaction of Carbon Monoxide and Hydrogen under Silent Electric Discharge—Part I. Influence of gas composition and the size of the ozoniser.

R. H. SAHASRABUDHEY and A. KALYANASUNDARAM (Benares)

Gas mixtures with varying proportions of carbon monoxide and hydrogen ranging from 1 : 0.5 to 1 : 3 were circulated. An excess of hydrogen favours the interaction of carbon monoxide and hydrogen. The yield of formaldehyde however, does not show a linear dependence on the proportion of hydrogen in the mixture or on the total reaction as indicated by the quantity of gas used up. The best yields of formaldehyde were obtained with gas mixtures in the range 1 : 0.9–1 : 1 of carbon monoxide and hydrogen. The apparent increase in rate of reaction, when hydrogen is in excess, is undoubtedly due to secondary changes.

With an increase in the length of the ozoniser, more of the gas mixture was found to react. A corresponding increase in formaldehyde production however, was not noticed. A yield of 3.8% of formaldehyde was obtained with a 1 : 1.2 gas mixture at gas flow of 8 litres per minute.

44. Formation of Formaldehyde during the Interaction of Carbon Monoxide and Hydrogen under Silent Electric Discharge—Part II.—Influence of rate of gas circulation and exciting potential.

R. H. SAHASRABUDHEY and A. KALYANASUNDARAM (Benares)

The observations reported in Part I suggested that an increased rate of gas flow might result in an increased yield of formaldehyde. The rate of circulation of the gaseous mixture was therefore, varied in the range 8–24

litres per minute. Contrary to expectations, the yield of formaldehyde decreased progressively with an increased rate of gas flow. This may be due to insufficient exposure of the gases to the exciting field or (ii) the inefficient absorption of formaldehyde by the absorbers. Investigations are in progress to elucidate these points.

Influence of applied potential ($V-V_m$) has been investigated. No reaction takes place below the threshold potential, V_m . At V_m , it is very slow. The overall reaction velocity as judged from the relative quantities of the gas mixture used up in a given time, increases progressively with the applied potential, the yields of formaldehyde on the other hand diminish. Formaldehyde formed as a primary product seems to decompose subsequently.

45. An Electrochemical approach to crystal chemical studies— Part II. The ion-dipole interaction at the mica-water interface in relation to the principle of microscopic neutrality.

R. P. MITRA and K. S. RAJAGOPALAN (Delhi)

When a muscovite crystal is split along its potassium-bearing plane, the K^+ ions distribute themselves equally between the two parts. If attention is now directed to the cleavage surface of one of the platelets, only one half of its exposed hexagonal rings of oxygens will be found to be occupied by K^+ ions, the other half being vacant. There will be an accumulation of 0.5 unit of (excess) positive charge in the region of an occupied ring while a vacant one will have 0.5 unit of negative charge located at its centre. The principle of microscopic neutrality will require that an occupied ring be surrounded by vacant ones and *vice versa* in a statistical sense. In other words, positive and negative charges, each 0.5 unit in strength, will be distributed on the surface with contiguous centres of charge carrying dissimilar charges. In contact with water, the muscovite crystal will seek to get rid of these local concentrations of opposite charges by interaction with the water dipoles in a manner such that the exposed potassiums are pulled out of their hexagonal cavities, or rings and made to take up positions in between contiguously situated rings. Such a redistribution of the surface potassiums following on their interaction with the water dipoles makes the surface statistically neutral on a smaller scale than in the dry crystal and lowers the potential energy of the system—as it should—in order that it may pass on to a stabler state of equilibrium. Each K^+ ion carrying one unit of positive charge in effect balances two 0.5 units of negative charges situated at the centres of adjacent hexagonal rings. Actually, the potassiums execute oscillations between these centres but taking the time average of this oscillatory motion they may be looked upon as occupying mean positions between the centres.

46. An Electrochemical Approach to Crystal Chemical Studies— Part III. The acid character of the micas.

R. P. MITRA and K. S. RAJAGOPALAN (Delhi)

The micas, muscovite and phlogopite, were finely ground in an agate mortar and materials having particles with equivalent spherical diameters smaller than 2.0 microns were leached with dilute HCl to obtain the corresponding hydrogen-, or, acid micas by the replacement of the exposed potassiums by hydrogen ions. Potentiometric titration curves of aqueous suspensions of these hydrogen micas with strong bases showed a weak tribasic acid character. Pauling, on the other hand, had predicted a very strong acid character for hydrogen muscovite on the basis of his electrostatic valence rules which are generally looked upon as the cardinal principles of crystal chemistry. Apparently, factors not coming within the purview of these rules are operative. The observed tribasic acid character, of the hydrogen micas indicates the presence of hydrogen ions in three different affinity levels on the

surface. The significance of these levels from the point of view of the lattice structure of the micas has been pointed out.

47. Electrodeposition of Iron.

M. A. RAHMAN and S. HUSAIN (Hyderabad-Deccan)

A systematic study of the electro-deposition of iron was undertaken in order to determine optimum conditions for the electro-deposition of the metal. Ferrous sulphate baths were investigated in the first instance. A platinum coil was used as an anode and an iron plate as the cathode. A canvas diaphragm was used around the anode to avoid disturbances in the solution due to evolution of oxygen at the anode. The solution was kept well stirred during the electrolysis and the temperature was maintained constant at 30°. It was observed that the cathode potential became more negative with the increase in current density and more positive with the increase in the acidity of the bath. The current efficiency increased with the rise in temperature and increase in the concentration of Fe^{++} . It was further noticed that the cathode potential became more positive as the current efficiency decreased. Adherent deposits of coherent mass were obtained on an iron base from baths containing 0.25 M. ferrous sulphate at a current density of 0.094 amp./cm.² at a temperature of 60° with a current efficiency of 98%. Presence of traces of sulphuric acid was found necessary to prevent the precipitation of hydroxides and basic salts.

48. Absorption and relaxation in Gases and Vapours.

S. K. K. JATKAR and D. LAXMINARAYANAN (Bangalore)

The futility of studying the combustion of fuels in engines by spectroscopic methods is obvious from the fact that the band spectra reveal only the presence of cracked radicals. The phenomena preceding the ignition is unknown. The dispersion of vapours observed by authors for linear and long chain compounds at comparatively low frequencies would indicate that in high speed internal combustion engines due to disappearance of the rotational and vibrational specific heats by the super-adiabatic phenomena, the vapours reach higher temperature on account of relaxation time, and knocking or pre-ignition takes place. The data on the explosion temperatures and pressures need revision as both oxygen and carbon dioxide are well known to show dispersion and relaxation. It has been found that the dispersion frequency depends upon van der Waals' constant 'a' and the ratio of moments of inertia of the molecule.

49. Molecular Heats of Gases and Vapours.

S. K. K. JATKAR, D. LAXMINARAYANAN and R. J. SUJIR
(Bangalore)

The molecular heats of gases and vapours have been measured by the ultrasonic method at 23 and 50 k.c. at different temperatures in N_2 , O_2 , CO , CO_2 , N_2O , C_2H_2 , C_2H_4 , CH_3CHO , $(\text{CH}_3)_2\text{O}$, $\text{CH}_3\text{OC}_2\text{H}_5$, CH_3Cl , $\text{C}_2\text{H}_5\text{Cl}$, CF_2Cl_2 and CH_3Br . Of these CO_2 and $\text{CH}_3\text{OC}_2\text{H}_5$ show dispersed values at room temperature.

50. Dielectric Constant of Liquids in Polar and Non-Polar Solvents.

S. K. K. JATKAR, B. R. Y. IYENGAR and N. S. BHATIA
(Bangalore)

The dielectric constants and densities of solutions of quinoline, nitrobenzene, chloroform, bromoform, benzylchloride, chlorobenzene, aceto-

phenone, benzaldehyde, paraldehyde, acetone, ethyl ether, 'o'-cresol, benzylamine, acetonitrile and benzonitrile have been studied in non-polar (benzene, carbon tetrachloride and dioxane) as well as polar solvents over the entire range of concentrations at various temperatures. The change in the freedom of orientation with the variation of these parameters, viz., temperature, concentration and solvent, finds quantitative basis in the new relationship which has been used to calculate moments which are discussed in relation to the structure of the molecules.

51. Dielectric Constant of Associated Liquids.

S. K. K. JATKAR and B. R. Y. IYENGAR (Bangalore)

The characteristic temperature θ in the mono-alcohols ethyl, propyl, butyl and amyl corresponds to their melting points. For methyl alcohol, which shows molecular rotation in the solid θ corresponds to the transition temperature indicated by specific heat measurements. Water, which also shows molecular rotation in the solid state has its θ considerably below M.P.

The moments calculated by the equation $(\epsilon - n^2) \frac{M}{d} = \frac{4\pi N\mu^2}{K(T - \theta)}$ correspond to those obtained in the vapour state or in dilute solutions. For hydrocyanic and hydrofluoric acids the characteristic temperatures are considerably below the melting point.

52. Dielectric Dispersion of Polar Liquids and Solutions.

S. K. K. JATKAR and B. R. Y. IYENGAR (Bangalore)

The inapplicability of Debye-Clausius-Mossotti equation to polar liquids is well known. A new relationship for the anomalous dispersion in polar liquids and solids has been derived on the basis of the theories developed by the authors. Dispersion formulae given by Cole, Fuoss and others have been critically reviewed. The data on anomalous dispersion of proteins, amino acids, water, alcohols and homologous methacrylates have been interpreted in terms of the dipole moments as involving a single relaxation time corresponding to the rotation of the huge dipole rather than two or more relaxations postulated by previous workers. The "molecular radii" derived from the observed relaxation times using the Stokes' law have been correlated with dipole moments obtained by applying a new relationship to the dielectric constant studies on solutions of various proteins and alcohols.

53. Molecular Diamagnetism and Refraction.

S. K. K. JATKAR, N. V. SATHE and K. P. WARKE (Bangalore)

The ratio ($\times 10^6$) of molecular diamagnetism to refraction is 4.5, for rare gases and fluorides, 3.5 for diatomic elements and most of the inorganic halides (except the bromides and iodides of Sr, Ba, Pb and Hg, for which the ratio is 3.0), 2.5 for aliphatic compounds (except halides) and 2.0 for aromatic compounds. The theoretical basis of this relationship is discussed.

54. Dipole moments of substituted Ethyl benzoates.

P. R. JOGALEKAR, N. L. PHALNIKAR and B. V. BHIDE (Poona)

The dipole moments of the following substituted ethyl benzoates have been determined from their dielectric constants and refractive indices at 30° in the liquid state using Onsager's equation:—

o-methoxy (2.26), *o*-chloro (2.38), *o*-bromo (2.29), *o*-nitro (4.12); *m*-methoxy (2.03), *m*-chloro (1.95), *m*-bromo (1.98), *m*-nitro (3.82), *m*-hydroxy (2.57), *p*-hydroxy (3.11) and *p*-methoxy (2.35). The figures in brackets represent dipole moments in Debye units. The results are discussed in relation to the structure of the esters and the influence of substituents.

55. Drought resistance of plants in relation to Hysteresis in Sorption.

K. SUBBA RAO, M. BHIMASENA RAO and B. SANJIVA RAO
(Bangalore)

The problem of drought resistance of plants has been investigated in relation to the hysteresis effect in sorption. As typical members of the drought resisting and nondrought resisting plants, grass and balsam were chosen for the study. Sorption and desorption of water vapour at 30° C. on the dehydrated leaves of the plants were conducted by employing the quartz fibre spring technique. Hysteresis effect was exhibited in both cases. The hysteresis effect is due to cavities which entrap water during desorption. Over the entire range of relative humidities, grass takes more water than balsam. The relative positions of the loops of the plants indicate that the cavities and their necks in the balsam leaf are much wider than those in the grass blade. This difference in the capillary structure of grass and balsam is probably one of the causes responsible for the difference in their drought resisting properties. The hysteresis effect exhibited by the leaves of a plant under varying conditions of drought, during the course of growth of the plant, is being investigated.

56. Kinetics of Consecutive Reactions: Hydrolysis of Nitriles.

G. G. MUJUMDAR, K. K. DOLE and D. D. KARVE (Poona)

In continuation of the previous work on the kinetics of consecutive reactions, the investigation has been extended to include the study of an important case of unimolecular, two-step, and non-reversible consecutive reaction, wherein the two sub-reactions involved proceed with the same rate (i.e., where k_1 is equal to k_2). Hydrolysis of propionitrile has been carried out in presence of sulphuric acid (5.38 N.), at 80° C., and the changes in concentrations of the original substance (nitrile), the intermediate product (amide) and the final product (ammonium salt) have been recorded. At this concentration of the catalysing acid, the hydrolysis of propionamide (k_2) also proceeds at the same rate as that of the nitrile (k_1). This is confirmed from an independent hydrolysis of propionamide under identical conditions. In the hydrolysis of the nitrile, the amide passes through a maximum concentration (9.15 c.c. when $a = 25$ c.c.) which is a specific one under such conditions. A mathematical treatment of the subject is possible on the basis of the present investigation.

57. Studies in Glass Systems—Magnetic Susceptibility of Gold dissolved in Borax Glass.

SUBODH KUMAR MAJUMDAR (Calcutta)

A suspension of metallic gold in borax glass was prepared by first heating auric chloride in a platinum crucible to about 210° and then heating it strongly (to about 800° C.) after mixing it with specially purified and dehydrated borax, until an apparently homogeneous melt was obtained. The melt was allowed to slowly solidify and the glass extracted. Different samples were prepared in this way, the maximum gold content being 3.12%. Gold, in a higher concentration, did not form a solid solution, but merely separated on the surface. The samples were isotropic under the Polarisation Microscope. The gold content of the samples was determined by an electrometric method used by Müller and Weisbrod (*Z. anorganische Chemie*, 1926, 17, 156). The diamagnetic susceptibility of the samples was determined by a Torsion Balance used by Krishnan and Banerjee (*Phil. Trans.*, 1935, A 231, 235). The value of the diamagnetic susceptibility of the dissolved gold was calculated from the Additivity formula: $100\chi = p \cdot \chi_1 + (100 - p) \cdot \chi_2$, where χ is the observed mass susceptibility of the glass, p , the % of gold, χ_1 its mass susceptibility of

gold in the dissolved state and χ_2 is the susceptibility of the borax. The calculated value of χ_1 for dissolved gold shows an increase over its normal value with increased concentration in the glass, the maximum increase found being about 10%. The results are in keeping with the author's previous experiments on polar crystals dissolved in glass. As there is no borate formation with gold, the observed increase can be accounted for, by supposing that the crystal lattice itself is enlarged on account of the introduction of a dielectric medium, as suggested by the author in previous publications.

58. On the application of the Equation to some Supersaturated Solutions.

RAM GOPAL (Lucknow)

An examination of the applicability of Hamburger-Harbury equation (*Chem. Weekblad*, 1938, **35**, 886; *J. Phys. Chem.*, 1946, **50**, 90) $\frac{\ln c/co}{(M/\rho)^{2/3}} = K$, concerning the activity of 'wall-germs' in supersaturated solutions, has been made in this paper. It is found that crystallisation of highly supersaturated solutions of urea, oxalic and succinic acids may be due to 'wall-germs'. The value of $\frac{\ln c/co}{(M/\rho)^{2/3}}$ has been found to be about 2400×10^{-5} .

The 'wall-germ' activity does not appear to have any influence on the low preheating effect on the spontaneous crystallisation of certain solutions, e.g., those of KBr, KI, KNO₃ and KClO₄, etc. The value of $\frac{\ln c/co}{(M/\rho)^{2/3}}$ varies from 2450×10^{-6} to 1470×10^{-5} .

59. Supersaturation Limits of Solutions—Part V.

RAM GOPAL (Lucknow)

The work on the limits of supersaturation in aqueous solution has been further extended. The results obtained confirm the previous observations that in most cases $T_s - T$ for any particular solute is almost independent of T_s . Further, $(T_s - T)\lambda$ has been found to be constant in a number of cases.

Considering λ , the heat of solution, as the lattice energy of the solute when it is kept in contact with the solvent water, an explanation for constancy of $(T_s - T)\lambda$ has been suggested.

It has been observed that preheating has a very little or negligible effect on $T_s - T$ in solutions of cinnamic, fumaric and maleic acids. It is pointed out that probably the unsaturated nature of these acids is responsible for this behaviour.

60. Supersaturation Limits of Solutions—Part VI.

RAM GOPAL (Lucknow)

Supersaturation limits of solutions of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$, NH_4ClO_4 , and $\text{Ba}(\text{ClO}_4)_2$ in water have been determined. The results appear to show that both the perchlorates studied here behave like KClO_4 (*J. Ind. Chem. Soc.*, 1943, **20**, 185), i.e., the limit of supersaturation $T_s - T$ is in general, not affected very much by the number of heatings and coolings. It remains almost a constant or varies only very slowly, unlike other salts of NH_4 and Ba such as $(\text{NH}_4)_2\text{SO}_4$, NH_4Cl , NH_4NO_3 , BaCl_2 and $\text{Ba}(\text{NO}_3)_2$, in which $T_s - T$ goes on markedly increasing with the duration and intensity of heating. This obviously shows a characteristic feature of ClO_4^- ion in the tendency of spontaneous crystallisation of these salts. The work is being extended to other perchlorates to discover the factor or factors responsible for this exceptional behaviour.

61. Study of the Compositions of Polychlorides from Solubility Data.

ARUN K. DEY (Saugor)

In a recent publication, Dey (*J. Ind. Chem. Soc.*, 1947, **24**, 207) has derived an expression for the calculation of the formulæ of polyiodides and polybromides from solubility data. In the case of polychlorides, however, chlorine does not show augmented solubility in alkali chlorides solutions but in presence of hydrogen chloride the solubility of chlorine is appreciably enhanced.

London has determined the values for the solubility of chlorine in hydrochloric acid solutions. From his data, the formulæ of the polychlorides have been calculated by the expression derived by Dey.

It is concluded that though the composition of hydrogen polychlorides depends on temperature, hydrogen trichloride seems to be the most predominant product at ordinary temperatures.

62. Studies in the formation of Complex Stannioxalates by Physico-Chemical Methods—Part I. Conductometric study of $\text{Sn}(\text{OH})_4\text{H}_2\text{C}_2\text{O}_4$ system.

ARUN K. DEY and A. K. BHATTACHARYA (Saugor)

In continuation of the studies in the complex formation between stannic tin and soluble organic acids and their salts (Dey and Bhattacharya, *Curr. Sci.*, 1945, **14**, 70; *Pro. Nat. Acad. Sci., India*, 1946) an attempt has been made to study the composition of the complex compounds formed between stannic hydroxide and oxalic acid. The method followed was the new electrical conductivity method adopted by the authors in their previous publications (*Curr. Sci.*, 1945, **14**, 69; *Nature*, 1946, **158**, 95). The conductometric curve gave breaks corresponding to the compositions of the compounds, $\text{Sn}(\text{C}_2\text{O}_4)_2$ and $\text{Sn}(\text{C}_2\text{O}_4)_3 \cdot 2\text{H}_2\text{C}_2\text{O}_4$, thus confirming the existence of the aforesaid compounds.

63. Studies in the formation of Complex Stannioxalates by Physico-Chemical Methods—Part II. Conductometric study of $\text{Sn}(\text{OH})_4\text{-K}_2\text{C}_2\text{O}_4$ system.

ARUN K. DEY (Saugor)

It has been observed (Dey, *Alld. Univ. Studies*, 1946, **22**, 7; Dey and Bhattacharya, *Proc. Nat. Acad. Sci., India*, 1946) that Potassium Oxalate has a stronger tendency to form complexes with stannic tin than oxalic acid. In this paper, the complex formation between stannic hydroxide and potassium oxalate has been investigated by the electrical conductivity method. From a study of the conductivity curve it has been concluded that the compounds formed are $\text{Sn}(\text{C}_2\text{O}_4)_2$ and $\text{Sn}(\text{C}_2\text{O}_4)_3 \cdot 2\text{K}_2\text{C}_2\text{O}_4$.

64. Studies in the formation of Complex Stannioxalates by Physico-Chemical Methods—Part III. Spectroscopic study of $\text{SnCl}_4\text{-H}_2\text{C}_2\text{O}_4$ system.

ARUN K. DEY and A. K. BHATTACHARYA (Saugor)

The absorption spectra of mixtures of stannic chloride and oxalic acid solutions of various compositions have been studied in the ultra-violet region with the aid of Hilger's constant deviation quartz spectrograph, using copper arc as the source. Different thicknesses of solutions were used in a Baly's tube for absorption. The different thicknesses of the solutions required for having absorption up to 2618 Å were noted. In a graph the required thicknesses were plotted against the compositions of the mixtures and the breaks in

the curve were assigned to be due to complex formation. It has been concluded that the compounds formed are $\text{Sn}(\text{C}_2\text{O}_4)_2$ and $\text{Sn}(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{C}_2\text{O}_4$.

65. Studies in the formation of Complex Stannioxalates by Physico-Chemical Methods—Part IV. Spectroscopic study of $\text{SnCl}_4\text{-K}_2\text{C}_2\text{O}_4$ system.

ARUN K. DEY (Saugor)

The method employed for the investigation of the complex formation between stannic chloride and potassium oxalate was the same as in Part III of the series. Evidence for the formation of the compounds $\text{Sn}(\text{C}_2\text{O}_4)_2$ and $\text{Sn}(\text{C}_2\text{O}_4)_2 \cdot 2\text{K}_2\text{C}_2\text{O}_4$ was obtained.

66. An Electrochemical Approach to Crystal Chemical Studies—Part I. The 'ion-dipole' interaction at a 'crystal-polar liquid' interface and its electrochemical consequences.

R. P. MITRA (Delhi)

The chemical responses of a crystal towards a liquid phase will largely depend on its solubility. The damping effect of a limited solubility on chemical reactivity may be materially counterbalanced by an extensive mechanical comminution of the crystal which would unleash numerous building units of the latter having sufficient residual valencies to enable them to enter into an energetic interaction with the liquid phase. If the crystal is of the ionic type, or, partially so, and if the liquid is a polar one, *e.g.*, water, a large number of polar groups and or ions which have been brought to the surface as a result of the comminution will interact with the dipoles of the liquid giving, if the comminution is of the right order, a stable suspension of the crystallites in the liquid. The stability of the suspension will be due to some sort of a 'surface dissociation' of the exposed polar groups and or ions as a result of their interaction with the solvent dipoles. This surface dissociation—its mechanism and that of the ion-dipole interaction have been discussed taking the mica-water interface as a model—will give to the suspension the character of a heterogeneous electrolytic system showing such familiar electrochemical features as quite definite and measurable conductivity and activity coefficients of the ions dissociated from the surface. It has been the object of the present series of papers to examine how far such features and their variations caused by the interactions of the crystallites with added electrolytes, *e.g.*, acids, bases and salts, are influenced by and, to that extent, reflect the nature of the building units of the crystal and the scheme on which they are built.

67. An Electrochemical Approach to Crystal Chemical Studies—Part IV. The acid character of hydroxyl groups in neutral layer-lattice silicates.

R. P. MITRA and K. S. RAJAGOPALAN (Delhi)

Many crystalline silicates have a layer-lattice structure. Some of them, *e.g.*, kaolinite and pyrophyllite, are made up of neutral layers held together by hydrogen bonds or weak van der Waal's forces. Hydroxyl groups present in the lattice frame-work of kaolinite and pyrophyllite are probably mainly responsible for their acid character and base combining power. Kaolinite has two types of OH groups in the lattice. In agreement with this, it shows a dibasic acid character when an aqueous suspension is titrated with a strong base. Pyrophyllite, on the other hand, has only one type of OH groups. This structural feature is in harmony with the fact that the potentiometric titration curve of pyrophyllite with a strong base resembles that of a weak monobasic acid.

68. A Note on Silverman's Equation for the Viscosity of Liquids

BALBHADRA PRASAD (Cuttack)

Silverman started with the idea that viscosity of a liquid could be represented by $\eta = Et$ where E is elasticity and t is the average life of associated complexes formed during the collision of molecules. He showed that $E = \frac{3}{2}$

where ε is compressibility and $t = \frac{k'V}{\sqrt{T}} e^{\frac{Q}{RT}}$. He further assumed that

$\varepsilon = ae^{-CT}$ so he obtained the equation $\eta = \frac{k'V}{\sqrt{T}} e^{\frac{Q}{RT} - CT}$. It was shown by the author that in case of some liquids C was negative and if C was assumed to be zero the equation still holds good. It has been shown that $\varepsilon = Ae^{-\frac{B}{T}}$

Therefore the Silverman's equation should take the form $\eta = \frac{kV}{\sqrt{T}} e^{\frac{Q}{RT}}$ which has the same form as the equation obtained by assuming that $C = 0$. Further $\frac{V}{\sqrt{T}}$ is either constant or an exponential function of temperature. Hence

this equation really reduces itself to the form $\eta = Ae^{\frac{h}{T}}$.

69. Apparent molal volume of Ammonium Chloride at 35° C

BALBHADRA PRASAD and PRASANNA KUMAR DAS (Cuttack)

Redlich and Rosenfeld by differentiating with respect to pressure the free energy equation of Debye and Hückel for strong electrolytes deduced an equation for the partial molal volume, $V = V_2 + a \sqrt{C}$. It was further shown that the apparent molal volume ϕ can also be represented by a similar equation $\phi = \phi_0 + K \sqrt{C}$ where the value of K is a constant. Experimental results showed that the volume of K was always of the same order.

$$K_{KCl}^{18} = 1.73, K_{NaCl}^{18} = 1.06, K_{KCl}^{25} = 2.20, K_{NaCl}^{25} = 0.26,$$

$$K_{KNO_3}^{35} = 0.96, K_{NaNO_3}^{35} = 1.20.$$

Recently Redlich and Bigeleisen have stated that if the above equation is written as $\phi = \phi_0 + K \sqrt{C} + K' C$, K is constant in case of HCl and KClO₃ at 25° C. Their experimental technique does not seem to be faultless.

Results obtained in this laboratory, with ammonium chloride do not support the views of Redlich and Bigeleisen. The equation however, admits another term as suggested by Redlich and Bigeleisen.

70. A new method of deriving Redox potential.

BALBHADRA PRASAD (Cuttack)

The usual method of deriving Redox potential based on the principle of maximum work given in text-books of Electro-Chemistry is so different from that used for deriving the Single Electrode potential that the similarity between Redox potential and single Electrode potential is sometimes lost sight of. A new proof of Redox potential, based on the principle of virtual work at equilibrium being equal to zero, has been given. As this principle is used in deriving single Electrode potentials also, the similarity between Single Electrode Potential and Redox Potential is clearly brought out.

71. The Variation of Absolute Viscosity with Temperature— Organic solutes in non-aqueous solvents.

A. N. BOSE and A. C. CHATTERJI (Lucknow)

The viscosity of a fairly large number of systems of non-electrolytes in non-aqueous solvents has been studied at various temperatures. It has been

found that the simple Andrade's equation $\eta = Ae^{-\frac{Q}{RT}}$ is applicable to most of the systems investigated in this paper. The deviations can be explained by Rabinovich's solvate hypothesis and the depolymerisation concept of Applebey.

72. The Variation of Relative Viscosity with Temperature— Organic solutes in non-aqueous solvents.

A. C. CHATTERJI and A. N. BOSE (Lucknow)

Results of a fairly comprehensive study of the temperature dependence of relative viscosity, $\frac{\eta_s}{\eta_0}$, of concentrated and supersaturated solutions of non-electrolytes in non-aqueous solvents are discussed in this paper. The observed values of $\frac{\partial}{\partial T} \left(\frac{\eta_s}{\eta_0} \right)$ can be divided into three categories (i) having approximately zero variation; (ii) having positive value; and (iii) having negative value for the variation of relative viscosity. In the majority of cases the results can be explained by Rabinovich's solvate hypothesis and the depolymerisation hypothesis of Applebey.

73. The Variation of Absolute Viscosity with Concentration— (Organic solutes in non-aqueous solvents.)

A. C. CHATTERJI and A. N. BOSE (Lucknow)

The viscosity of non-electrolytes in non-aqueous solvents has been studied in this paper at different concentrations. It has been shown that Tamini's second equation, $\ln \eta = \theta c + \phi$, is more applicable to these systems, than the first equation, $\eta = mc + n$. The value of θ and ϕ of the second equation, have been calculated. This equation of Tamini is equivalent to the equation of Arrhenius $\frac{\eta_s}{\eta_0} = A^c$ or $\ln \frac{\eta_s}{\eta_0} = c \ln A$ or kc .

Tamini (*J. Phys. Chem.*, 1928, **32**, 604; 1929, **33**, 56) has shown that the second equation is not applicable to concentrated aqueous solutions. On the other hand he found that the first equation $\eta = mc + n$ is applicable to most of the supersaturated aqueous solutions investigated by him. In this laboratory it was also found that the first equation of Tamini, $\eta = mc + n$ is generally applicable to supersaturated aqueous solutions of electrolytes. Results obtained in this laboratory show that Arrhenius's equation or rather a modified form of it, as given by Tamini, is generally applicable to supersaturated non-aqueous solutions. Investigations are in progress to find out the cause of the difference between the behaviour of these two types of supersaturated solutions.

74. Dissociation Constant of Aceto-lead complex cation

SHRIPATI PANI (Cuttack)

The dissociation of the Aceto-lead complex cation has been studied by the E. M. F. method. The results obtained are discussed.

75. Magnetic study of mercuric and mercurous compounds.

MATA PRASAD, S. S. DHARMATTI and A. K. GHOSE (Bombay)

The magnetic susceptibilities of a large number of inorganic and organic compounds of mercuric and mercurous mercury have been determined by a modified Gouy's balance. The experimental values of the susceptibilities have been compared in different ways with the theoretical ones obtained by the methods of Slater and Angus, and it has been found that they are lower than the theoretical, especially in the case of the mercurous ion. The relationship between the molar susceptibility and the number of electrons in the compound has been studied graphically, and together with magnesium, zinc and cadmium, the sub-group characteristics have been analysed. From the graphs, values of different anions have been obtained and these have been discussed on the basis of the group characteristics. Ionic radii have been calculated for both the states from the ionic susceptibilities and have been compared with the values obtained by other methods.

Organic Chemistry

76. Bromination of some aryl esters of salicylic acid.

G. V. JADHAV and R. M. THAKKAR (Dharwar)

o-, *m*-, and *p*-Cresyl, *p*-nitrophenyl and β -naphthyl salicylates gave *o*-, *m*-, *p*-cresyl, *p*-nitrophenyl and β -naphthyl 5-bromo-salicylates, when brominated in acetic medium and using theoretical quantity of bromine. *m*-Nitrophenyl salicylate gave *m*-nitrophenyl 5-bromosalicylate in chloroform medium.

Nitrophenyl salicylates gave nitrophenyl 3 : 5-dibromo salicylates, when more bromine was used in acetic acid medium, whilst *o*-, *m*-, *p*-cresyl 3 : 5-dibromosalicylates were obtained from the corresponding 5-bromo-salicylates by using acetic acid solution of bromine in required proportion.

77. Bromination of some aryl esters of 5-nitro-salicylic acid.

G. V. JADHAV and R. M. THAKKAR (Dharwar)

Bromination of phenyl 5-nitrosalicylate gave phenyl 3-bromo-5-nitrosalicylate (A) in acetic acid medium whilst 4-bromophenyl 5-nitro-salicylate (B) was obtained with liquid bromine. Both (A) as well as (B) gave 4-bromo-phenyl 3-bromo-5-nitro-salicylate (C), the former by bromination with liquid bromine and the latter by bromination in acetic acid medium. (C) was obtained from phenyl 5-nitrosalicylate by the action of liquid bromine in presence of iodine catalyst.

o-Cresyl 5-nitrosalicylate also gave *o*-cresyl 3-bromo-5-nitrosalicylate (D) by bromination in acetic medium and 5 : 6 dibromo-*o*-cresyl 5-nitrosalicylate (E) by using liquid bromine. Both (D) and (E) gave 5 : 6 dibromo-*o*-cresyl 3-bromo-5-nitro-salicylate (F) by brominating (D) with liquid bromine and (E) with acetic acid solution of bromine. (F) is also obtained from *o*-cresyl 5-nitrosalicylate with liquid bromine in presence of iodine catalyst.

m-Cresyl 5-nitrosalicylate gave *m*-cresyl 3-bromo-5-nitrosalicylate and 4-bromo-*m*-cresyl-3-bromo-5-nitro-salicylate when bromination was done in acetic acid medium, depending upon the temperature of the reaction. It gave 2 : 4-dibromo-*m*-cresyl-5-nitrosalicylate with liquid bromine, which dibromo compound gave 2 : 4-dibromo-*m*-cresyl 3-bromo-5-nitro-salicylate when brominated in acetic acid medium. The last compound was also obtained from *m*-cresyl 5-nitro-salicylate by the action of liquid bromine in presence of iodine catalyst.

Similar interesting results were obtained in the case of *p*-cresyl 5-nitrosalicylate. Nitrophenyl 5-nitrosalicylates gave only nitrophenyl 3-bromo-5-nitro-salicylates by bromination in acetic acid medium.

78. Bromination of some aryl esters of 3-nitro-salicylic acid.

G. V. JADHAV and R. M. THAKKAR (Dharwar)

Bromination of phenyl, *o*-cresyl, *m*-cresyl 3-nitro-salicylates in acetic acid solution at higher temperatures gave phenyl, *o*-cresyl, and *m*-cresyl 3-nitro-5-bromo-salicylates. If however, the bromination of these esters is done with liquid bromine, phenyl 3-nitrosalicylate gave 2:4-dibromophenyl 3-nitrosalicylate; *o*-cresyl 3-nitro-salicylate gave 4-bromo-*o*-cresyl 3-nitrosalicylate; and *m*-cresyl 3-nitro-salicylate gave 4-bromo-*m*-cresyl 3-nitrosalicylate.

79. Interaction of Bromine and Thiocarbamide. Dimorphism of Formamidine Disulphide Salts.

R. H. SAHASRABUDHEY (Benares)

Bromine reacts with thiocarbamide in a dry chloroform medium forming a deep yellow-orange dibromo compound $\text{CSN}_2\text{H}_4\text{Br}_2$, which is not a simple addition product but has the constitution of a perbromide as evinced by the lability of its bromine to potassium iodide. The influence of various factors on its capacity of setting free iodine has been investigated. The dibromo-compound is extremely sensitive to moisture and in presence of the latter immediately decomposes into the hydrobromide of the well-known oxidation product of thiocarbamide, the so-called formamidine disulphide.

The nitrate and the picrate of formamidine disulphide were prepared by Werner's method, as also by using other oxidizing agents. In disagreement with the statements of the earlier workers it has been found that they melt at $82-85^\circ$ or $138-140^\circ$, and 154° or 164° respectively. The manifestation of two melting points by these salts is evidently due to dimorphism.

80. Action of Sulphur monochloride on Thiocarbamide and Thiocarbanilide.

R. H. SAHASRABUDHEY (Benares)

Sulphur monochloride reacts in an inert solvent medium with thiocarbamide and thiocarbanilide forming salts of formamidine disulphide and phenylaminobenzthiazole respectively; a trisulphide or a tetrazine is not produced as postulated by Naik (*J.C.S.*, 1921, 119, 1166). In these reactions it plays the role of an oxidizing agent.

The action of sulphur monochloride was also tried in aqueous, dil. alcoholic and aqueous acidic media on the thiocarbamides under investigation but under these conditions the reagent appeared to decompose completely and no oxidation product whether a disulphide, a benzthiazole, or a thiodiazole could be isolated.

81. Complex Zinc Compounds of the tris-series with ethylene diamine and propylene diamine.

KANAI LAL MANDAL (Calcutta)

Ethylene diamine dipropylene diamine zinc salts have been prepared by combining one molecule of a zinc salt with two molecules of propylene diamine and one molecule of ethylene diamine. Similarly propylene diamine diethylene diamine zinc compounds have been obtained by combining one molecule of a zinc salt with two molecules of ethylene diamine and one molecule of propylene diamine. Though various reagents have been tried, it has not been possible to resolve zinc salts of the above two classes of compounds of the tris-series. By using *l*-propylene diamine obtained by the resolution of racemic propylene diamine $\text{NH}_2\text{CH}_2\text{CH}(\text{NH}_2)\text{CH}_3$ laevorotatory complex zinc salts were obtained.

82. Electric Moment of Hexachloro-cyclohexanes.

S. K. K. JATKAR *and* (MISS) S. B. KULKARNI (Bangalore)

Commercial hexachloro-cyclohexane was separated into four isomers alpha, beta, gamma, delta, melting at 158° C., 309° C., 112.5° C. and 138° C., by fractional crystallisation from methyl alcohol. The dielectric properties of the four isomers were studied. The beta isomer, with 3 chlorine atoms in upper plane and the three others in lower plane, has zero moment. The gamma isomer (which is a very effective insecticide) has the highest moment (2.55D) which is independent of solvent and in agreement with the moment 2.55D of pure molten gammexane. The alpha isomer has a moment of 1.7D. Further work is in progress.

83. Dipole Moment of Aceto-acetic ester and Hydroxy benzoic Acids.

S. K. K. JATKAR *and* (MISS) S. B. KULKARNI (Bangalore)

The dipole moment of pure aceto-acetic ester is 3D between 20–130° C., in good agreement with the vapour value of 2.95 D. The moment in benzene and carbon tetrachloride varies from 2.5 to 2.7 D. with change of concentration between 5 to 39%. Dielectric properties of *o*, *m*, *p* hydroxy benzoic acids in dioxane at various concentration and temperature were studied. The moments, for ortho, meta and para hydroxy benzoic acids are 2.7, 2.2 and 2.55 D respectively.

84. Electric Moment of Some Drugs.

S. K. K. JATKAR *and* (MISS) S. B. KULKARNI (Bangalore)

Dielectric properties of sulfanilamide and its related compounds were studied in dioxane. Moment of sulfanilamide (5.4 D) is the vector sum of the moment of aniline (1.5) and benzene sulfonamide (4.1). Similarly moments of *p*-phenyl benzene sulfonamide $C_6H_5C_6H_4SO_2NH_2$ and *p*-amino-phenyl benzene sulfanilamide are 4.3 and 5.6 respectively. The values of the moment for barbitone and phenobarbitone are 1.10 and 1.15 D. Moment of *p*-ethoxy acetanilide is 5.3 in dioxane and 5.5 for pure molten liquid and is the vector sum of acetanilide 3.8 and the ethoxy group. Acetyl salicylic acid has a moment of 2.0 independent of concentration and solvent. Santonin has a high dipole moment of the order of 5.0 D. The moment for ascorbic acid is 3.2 D.

85. Dielectric Constant of Hydrogen Halides, Cyclohexanol, Camphor, Dimethyl Sulfate, &c.

S. K. K. JATKAR *and* (MISS) S. B. KULKARNI (Bangalore)

The moments of hydrogen halides cyclohexanol, hydrogen sulfide in solid and liquid state and that of camphor in solid state are calculated by the new equation $(\epsilon - n^2) \frac{M}{d} = \frac{4\pi N h^2}{K(T - \theta)}$, where θ is the characteristic temperature corresponding to the observed temperature of transition at which the dielectric constant suddenly changes to a peak value. The observed values of θ are 98.4, 89.8, 66, 103 and 200° K. for HCl, HBr, HI and H₂S and cyclohexanol. For camphor the calculated θ is 58° K. The moments calculated correspond to those obtained in vapour or in dilute solution. The moments of dimethyl sulfate and diethyl sulfate calculated from the dielectric constant of pure liquid are 4.97 and 4.55 D. The high dielectric constant of the solids show that there is partial rotation of the molecules in the solid, the moment of which is diminished by coordination below the transition temperature.

86. Studies on the Formation of Grignard Reagent.

S. A. FASEEH and S. H. ZAHEER (Lucknow)

While attempting to effect a synthesis of phenanthrene and substituted phenanthrenes it was noticed (*Proc. Ind. Sci. Cong.*, 1941, p. 88) that while *o*-iododiphenyl reacted readily under the usual conditions with magnesium in ether solution giving an yield of 80% the Grignard reagent: all effort to prepare the magnesium derivative of substituted nitro or amino iododiphenyl proved unsuccessful. Slotta and Heller (*Ber.*, 1930, **63**, 3044) have also noted the failure of ortho and para bromonitrobenzene to react with magnesium in presence of ether, iso-amyl ether or otherwise. This failure induced us to make an extensive search in the literature of the last forty years and the present authors found no mention of the formation of magnesium derivatives of an aromatic halide which in addition also contain a second substituent which is either a nitro or amino group, the only exception being the preparation by Baeyer of the Grignard reagent of the ortho and meta iodoanilines (*Ber.*, 1905, **38**, 2759, 2767).

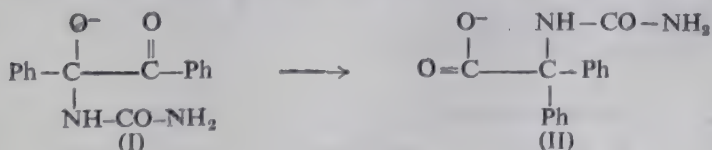
o-Chloro (and bromo) diphenyl, *o*, *m*. and *p*. chloroanilines and nitrobenzenes do not form Grignard reagent under the usual condition. By heating these compounds (in absence of air) with magnesium in sealed glass tubes the following % of the Grignard reaction has been obtained. *o*-Chloro diphenyl (32%) *o*-bromo-diphenyl (18%): ortho, meta and para chloroanilines (6%, 14% and 33% respectively). Ortho, meta and para chloronitrobenzene failed completely to produce any reaction.

87. Preparation of 5 : 5-diphenylhydantoin.

J. SIKDAR and T. N. GHOSH (Baranagar, Calcutta)

5 : 5-Diphenylhydantoin, (an anticonvulsant used in the treatment of epilepsy), can be prepared according to the method of Biltz (*Ber.*, 1908, **41**, 1379) which consists in treating benzil with alcoholic alkali and then heating the mixture with urea. As is well known benzil, when treated with alcoholic alkali, undergoes molecular rearrangement to benzilic acid. It was, therefore, thought that in the method of Biltz, benzil is first converted to the alkali salt of benzilic acid, which then reacts with urea to yield the alkali salt of 5 : 5-diphenylhydantoin. But, it is found that by heating, under identical conditions, the alkali salt of benzilic acid with urea in presence of alcohol, no reaction takes place.

With regard to benzilic acid rearrangement, Ingold (*Ann. Repts. Chem. Soc.*, 1928, **25**, 124; 1933, **30**, 177) has proposed the existence of an intermediate negative ion, produced by the addition of hydroxyl ion to benzil and has indicated the importance of an alkaline medium in the transformation. The above observations can be explained on the basis that urea first reacts with this intermediate negative ion and the complex (I), thus formed, next isomerises to (II), ultimately forming 5 : 5-diphenylhydantoin by cyclisation. This mechanism has been further substantiated by other experimental observations.



88. Modification of Skraup's Reaction.

S. J. DAS GUPTA (Calcutta)

The Skraup's reaction for the synthesis of quinoline has been modified by various authors from time to time. In all these modifications the amino compound is mixed with the corresponding nitro compound. No modification

has yet been made in which the use of the amine is dispensed with and the nitro compound alone can be directly and safely converted to the quinoline. The author has found out a modification by which quinoline compounds can be prepared directly from the nitro compounds alone, without the slightest chance of the reaction becoming violent. A mixture of nitro compound (1 part), glycerine (3 parts) and conc. sulphuric acid (3 parts) is prepared in cold and diluted with pure formic acid (3 parts) and then refluxed under stirring at about 150° C. for several hours. The quinoline is then isolated in the usual manner.

89. Synthesis of the lactone from α -hydroxy- β -isopropyl adipic acid, the degradation product of β -phellandrene.

D. CHAKRAVARTI and C. N. BHAR (Calcutta)

The lactone from α -hydroxy- β -isopropyl adipic acid, the degradation product of β -phellandrene has been synthesised. Dimethyl levulinic ester has been condensed with cyanacetic ester and the condensation product reduced to ethyl α -cyano- β -isopropyl adipate, which has been hydrolysed to the tri-carboxylic acid and the latter brominated and the bromo compound decomposed to α -bromo- β -isopropyl adipic acid. The above bromo compound is converted into the hydroxy acid which on distillation gives the required lactone.

90. An attempt to prepare Indigoid Dyes from acenaphthene-3-sulphonic acid.

PARESH CHANDRA DUTTA (Muzaffarpur)

Acenaphthene-3-sulphonic acid (*Ber.*, 1924, 57, 1531) has been converted to the sulphochloride and the sulphochloride to the mercaptan by reduction. This mercaptan has next been converted to the thioglycollic acid and the thioglycollic acid to the acid chloride. But the yields of the acid and the acid chloride have been too small to make further work possible.

91. Chemical Examination of the Seeds of *Myristica attenuata*.

A. N. POTI and K. RAMACHANDRAN NAIR (Trivandrum)

The crushed seeds of *Myristica attenuata* on extraction with petroleum ether gave two crystalline substances, A and B and a fixed oil.

The substance A which separates from the extract at ordinary temperatures when recrystallised from alcohol gave long slender plates melting point 123° C. and showed all the characteristic colour reactions of phytosterols.

The substance B separating from the extract kept in a frigdeaire gave small needles melting point 98° C. when recrystallized from petrol ether. It dissolved in sodium bicarbonate with the liberation of carbon dioxide and gave an intense violet colouration with ferric chloride showing that it might be a phenolic acid. The fixed oil obtained on evaporation of the petrol, solidified to a fat melting at 34° C.

Further work is in progress.

92. The Active Principles of the Seeds of *Swietenia macrophylla*.

A. N. POTI and K. RAMACHANDRAN NAIR (Trivandrum)

From the seeds of *Swietenia macrophylla* two non-nitrogenous crystalline substances A and B have been isolated.

The substance A ($C_{16}H_{22}O_6$) which crystallizes in rhombic plates melts at 182-183° C. and is intensely bitter to taste. It is insoluble in sodium bicarbonate but slowly goes into sodium hydroxide and is regenerated unchanged by acids. When boiled with sodium hydroxide and then acidified a distinctly

acidic white powder is precipitated. These reactions show the original substance to be a lactone. It reduces Tollens reagent indicating unsaturation at the β -position to the lactone ring.

The substance B ($C_{19}H_{26}O_5$) separates in beautiful shining prisms melting at 267° (decom.). It does not go into solution even in boiling alkali, gives a positive test with Tollens reagent and fails to give any acetyl or benzoyl derivatives. It gives a red colouration with Hesses reagent and with Leibermann-Burchardt reagent an yellow colouration which gradually turns brown.

Further work is in progress.

93. Glyceride Constitution of the fixed oil from the seeds of *Entada scandens*.

A. N. POTI and K. RAMACHANDRAN NAIR (Trivandrum)

After the removal of fully and disaturated glycerides by crystallization from acetone the oil was brominated in petroleum ether at 0° C. The solid and liquid bromoglycerides were further resolved into a number of fractions by different solvents. The fractions were then debrominated, saponified and acids liberated. The quantity of individual acids in each fraction was determined. From the component fatty acids in various fractions the different types of glycerides in the fractions were calculated. Assuming that the solid acids are proportionately divided in the different glycerides, the component glycerides of the oil may be given as: Disaturated olein, 12.95%; Lignocero-diolein, 2.01%; Stearodiolein, 1.17%; Palmitodiolein, 1.78%; Lignocero-oleolinolein, 2.21%; Stearooleiolinolein, 1.28%; Palmitooleolinolein, 1.95%; Dioleiolinolein, 26.69%; Triolein, 48.56%; Triolein, 1.4%.

94. Glyceride Constitution of the fixed oil from the seeds of *Swietenia macrophylla*.

A. N. POTI and K. RAMACHANDRAN NAIR (Trivandrum)

Oxidation Method—

1. The oil was oxidized by acetone permanganate and fully saturated glycerides separated.

2. From the oxidation mixture, after the removal of products easily soluble in sodium bicarbonate (like triazelain) and aliphatic acids the mixture of mono- and di-azelaoglycerides is dried and weighed and its saponification value determined.

3. The azelaic mixture was extracted with 10% sodium bicarbonate which removed only the diazelaoglycerides. It was regenerated, dried and saponification value determined.

4. From the values of (2) and (3) and knowing the amount of saturated acids present in the oil the value of mono- and di-azelaoglycerides were calculated.

5. Thus the different types of glycerides present in the oil are: (1) Fully saturated glycerides, 12.38%; (2) Disaturated mono-unsaturated glycerides, 12.69%; (3) Monosaturated diunsaturated glycerides, 46.74%; (4) Tri-unsaturated glycerides. (by diff.) 28.19%.

95. 6-Amino- α -methyl indole-2-carboxylic acid ethyl ester.

S. H. ZAHEER and V. S. MISRA (Lucknow)

The above mentioned compound, first claimed to have been prepared by Reissert and Heller (*Ber.*, 1904. 37; 4364) was prepared by us by a new method in the expectation that the compound and more particularly its methyl derivatives might have therapeutic properties. While Reissert and Heller obtained a yield of only 10%, we succeeded in obtaining a 57% yield.

The starting material was 2;4 dinitrophenyl acetoacetic ester prepared by the method of Borsche (*Ber.*, 1909, **42**; 601) and not by the method of Day and Doraiswami (*J.I.C.S.*, 1933, **10**; 309-20) which proved completely unsuccessful. By adopting minor modifications of the Borsche method we succeeded in obtaining an almost theoretical yield of 2;4-dinitrophenyl acetoacetic ester.

2;4-dinitro-phenyl acetoacetic ester on reduction with iron powder and water in presence of small quantities of ferrous sulphate as catalyst gave a 57% yield of 6-amino- α -methyl-indole 2-carboxylic acid ethyl ester.

The identity of this compound was established by analysis and by the preparation of the benzoyl and 2;4 dinitro chlorobenzene derivatives. The compound also gives a positive carbylamine test.

On methylation, the amino compound yields a crystalline derivative (m.p., 101-102°) whose identity has however not yet been fully established.

96. Chemical Investigation of the Bitter-Principle of *Swietenia Mahogani*.

K. A. LATIFF and S. S. GUHA SIRCAR (Dacca)

The bitter principle from the seeds of *Swietenia Mahogany* (N. O. Meliaceae) was found to have a tentative molecular formula of $C_{21}H_{30}O_7$. It contained no nitrogen and no aldehyde or ketone or glucosidal group, but contained possibly a tertiary alcohol, two methoxy and a lactone-group. It was unsaturated and combined with one mol. of bromine and one mol. of hydrogen.

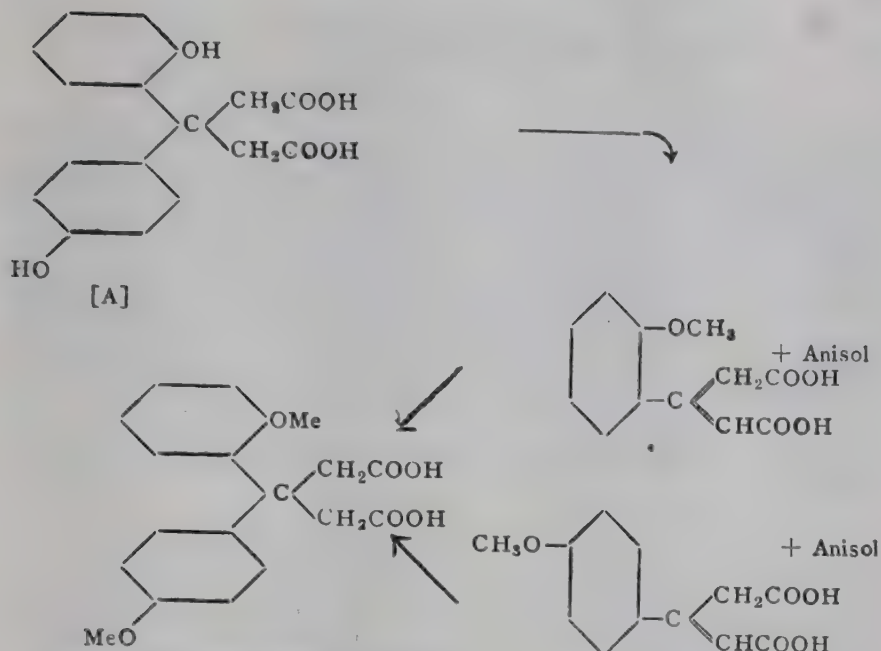
97. Constitution of the $\beta\beta$ -diaryl glutaric acids synthesised from phenols.

V. M. DIXIT and V. U. PADUKONE (Dharwar)

When phenol is condensed with acetone dicarboxylic acid in the presence of 75% sulphuric acid, the product contains a dibasic acid (m.p. 234° C. decomp.) in addition to the expected coumarin-4-acetic acid (m.p., 176° C. decomp.). Dixit and Gokhale (*J. Univ. Bom.*, 1934, **3**, 80) have suggested a constitution of $\beta\beta$ -di-2-hydroxyphenyl-glutaric acid for the new acid assuming that the condensation takes place in the ortho position to the -OH group in both molecules of the phenol. Gogte (*Proc. Ind. Acad. Sci.*, 1935, **2A**, 185) however assigns a constitution of $\beta\beta$ -di-4-hydroxyphenyl-glutaric acid for the same compound on the basis of a para condensation.

On heating with 95% sulphuric acid, the dibasic acid (m.p. 234° C.) gave a good yield of coumarin-4-acetic acid (m.p. 176° C. decomp.) as observed by Dixit and Gokhale (*loc. cit.*). The acidic filtrate from the above experiment, on bromination, gave the expected tribromophenol (m.p. 93° C.) and a dibasic acid containing bromine. This dibasic acid is considered to be a dibromo derivative of either the β -2-hydroxyphenyl glutaconic acid or the β -4-hydroxyphenyl glutaconic acid.

The original dibasic acid (m.p. 234° C. decomp.) was converted to its dimethyl derivative (m.p. 156° C.). This compound was found identical with the glutaric acid obtained by the condensation of anisol with either the β -4-methoxyphenyl glutaconic acid (m.p. 176° C. decomp.) or the β -2-methoxy-phenyl glutaconic acid (m.p. 155° C. decomp.) in the presence of 75% sulphuric acid. It appears therefore that the constitution of the original glutaric acid (m.p. 234° C. decomp.) is not symmetrical as represented before but is unsymmetrical as in (A).

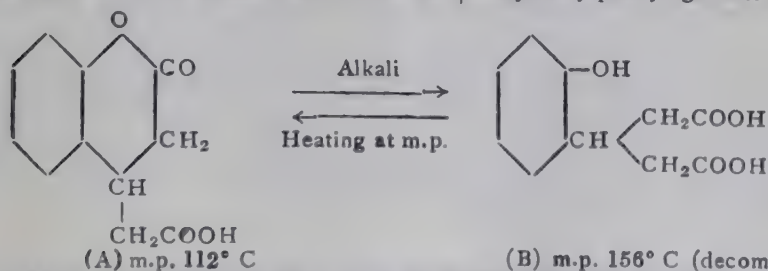


98. Synthesis of Hydro-coumarins: 3:4-dihydro-coumarin-4-acetic acid.

V. M. DIXIT and V. U. PADUKONE (Dharwar)

Coumarin-4-acetic acid which was prepared by condensing phenol with acetone dicarboxylic acid in the presence of 75% sulphuric acid according to the method of Dixit and Gokhale (*J. Univ. Bom.*, 1934, 3, 80) was reduced by sodium amalgam in alkaline solution. The product consists of (A) a monobasic acid and (B) dibasic acid.

The monobasic acid is considered to be the 3:4-dihydro coumarin-4-acetic acid and the dibasic acid to be the β -2-hydroxy-phenyl glutaric acid.



(A) can be converted to (B) by hydrolysis with alkali and the reverse change is brought about by heating (B) slightly above its melting point. The identity of the glutaric acid (B) was confirmed by methylating it and identifying the methyl derivative with β -2-methoxy phenyl glutaric acid which was prepared from the known β -2-methoxy phenyl glutaconic acid (m.p. 155° C. decomp.) by reduction with sodium amalgam (Dixit, *J. Ind. Chem. Soc.*, 1931, 8, 787). The β -2-methoxy phenyl glutaconic acid was obtained by subjecting coumarin-4-acetic acid to hydrolysis and methylation (Gogte, *Proc. Ind. Acad. Sci.*, 1934, 1, 48).

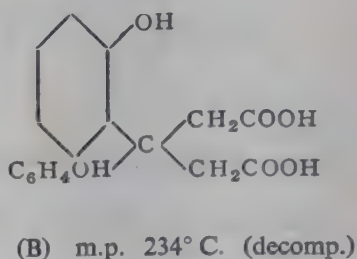
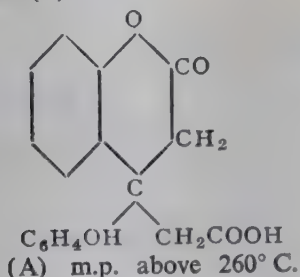
The work is being extended to coumarin-4-acetic acids prepared from other phenols, cresols and naphthols.

99. Synthesis of $\beta\beta$ -diaryl glutaro-lactones.

V. M. DIXIT and V. U. PADUKONE (Dharwar)

With the object of securing a direct synthesis of some of the $\beta\beta$ -diaryl glutaro-lactones described by Dixit, Kankudti and Mulay (*J. Ind. Chem. Soc.*, 1945, **23**, 207), $\beta\beta$ -di-2-hydroxy phenyl-glutaric acid (m.p. 234°C . decomp.) was prepared by the method of Dixit and Gokhale (*J. Univ. Bom.*, 1934, **3**, 80) and then heated for a few hours with phosphorus oxychloride in a dry atmosphere. Instead of the expected neutral dilactone, the product was found to be a monobasic acid (Eq. Wt. 300) which melted at a high temperature (above 260°C .) with charring. It was sparingly soluble in most of the organic solvents, but could be crystallised from a large quantity of glacial acetic acid. It gave a green colouration with ferric chloride and a sparingly soluble sodium salt. It gives the original glutaric acid (m.p. 234°C . decomp.) by hydrolysis with alkali and coumarin-4-acetic acid (m.p. 176°C . decomp.) by the action of hot conc. sulphuric acid.

The new acid is therefore considered to be a monolactonic acid of the formula (A).



The action of phosphorus oxychloride has been extended to the other $\beta\beta$ -diaryl glutaric acids and the constitution of the resulting monobasic acids is being further investigated.

100. The fixed oils from the livers of Ballistis.

K. SADASIVAN PILLAI and N. S. VARIER (Trivandrum)

Large shoals of Ballistis visit the Travancore Coast every year, the maximum being once in six years. Considerable quantities are caught every year. The demand for the fish being poor, its oil is extracted in quantities.

The following are its physical and chemical characteristics:—Density (at 31°C .), 0.9275; Refractive Index (at 28°C .), 1.450; Acid value, 2.436; Sap Value, 192.05; Reichert-meissel Value, 0.2574; Reichert-Polenske Value, 3.9; Iodine Value (Wij's), 149.5; Acetyl Value, 127.12; Hehner Value, 83.71; Mean Molecular weight of mixed fatty acids, 331.9; Solid Fatty Acids, 55.7%; Liquid Fatty Acids, 39.0%; Iodine Value of mixed acids, 157.2; Unsaponifiable matter, 1.175%.

Further work is in progress.

101. Chemical examination of the tubers of *Cyclea burmanni*, Part III.

P. V. NAIR and (MISS) P. SARADAMMA (Trivandrum)

In Part I of this series (*Abs. Proc.*, I.S.C., 1946) the authors have reported the isolation of two alkaloids (m.p. 218° and 158°C .) from the tubers of *Cyclea burmanni*. These are being provisionally named "Burmantine" and "Burmanneline". Burmannine on oxidation with permanganate in acetone solution furnished a nitrogen-free acid (m.p. 307° – 310°C .) which is under examination. The results of the action of nitric acid and of the zinc-dust distillation of the alkaloid are also set forth in the paper.

102. Chemical examination of the roots of *Tiliacora racemosa*, Part II.

P. V. NAIR and (MISS) P. SARADAMMA (Trivandrum)

The isolation of a well-defined crystalline alkaloid (m.p. $204.5^{\circ}\text{C}.$) from the alcoholic extract of the roots was reported in a previous communication (*Abs. Proc., I.S.C., 1947*). In its properties and derivatives, the alkaloid had very little in common with tiliacoron (m.p. $260^{\circ}\text{C}.$) which Van Itallie and Steen Hauer (*J. Soc. Chem. Ind., 1923, 153 A*) isolated from the bark of *Tiliacora acuminate*. The preparation of some of the derivatives of the new alkaloid and its oxidation with alkaline permanganate are described.

103. Essential Oils of Travancore—Part I. Oil from Cloves grown in S. Travancore.

K. N. GOPINATHAN NAIR, P. V. NAIR and N. S. VARIER (Trivandrum)

Clove cultivation was recently started at Nagercoil in S. Travancore. The present paper deals with the constants of an oil distilled from a recent crop. The moisture-free material afforded 15.5 per cent. of oil which works to roughly 9.4 per cent. on the bulk weight (including stalks) of the trade sample. The oil gave the following values:—Moisture, 8.8%; Ash Value, 6%; Density ($30^{\circ}\text{C}.$), 1.057; Acid Value, 1.02; Sap. Value, 51.85; Phenols (Absorption with 5% KOH), 92.5%; Acetyl Value, 211.2; Ref. Index ($30^{\circ}\text{C}.$), 1.532.

104. Molecular rearrangement of *o*-Acyloxy and *o*-Aroyloxy Acetoarones using Metallic Sodium.

SHARAD S. PANDIT and SURESH SETHNA (Bombay)

Orcacetophenone diacetate was heated with pulverised sodium in toluene solution. The product obtained on acidification was found to be 7-hydroxy-4-acetomethyl-5-methylcoumarin. This on deacetylation gave 7-hydroxy-4 : 5-dimethylcoumarin (Sethna and Shah, *J. Ind. Chem., Soc., 1940, 17, 242*). These compounds were directly compared with authentic specimens of the same prepared by Sethna and Shah.

Work on the transformation of orcacetophenone dibenzoate and the diacetates and dibenzoates of quinacetophenone and respropiofenone is in progress.

105. Chalkones from Orcacetophenone and its Monomethyl Ether.

P. B. MAHAJANI and SURESH SETHNA (Bombay)

Orcacetophenone has been condensed with benzaldehyde, *p*-hydroxy benzaldehyde and anisaldehyde in presence of very concentrated caustic potash solutions. The products obtained are found to be chalkone derivatives. The monomethyl ether of orcacetophenone similarly condenses with the above aldehydes to give the corresponding monomethyl ethers of the chalkones. The dihydroxy and the monomethoxy chalkones have been methylated and the dimethyl ethers have been obtained.

The work on the condensation of 2-acetyl resorcinol and its monomethyl ether with the above aldehydes is in progress.

106. Bromination of Methyl 7-Hydroxy-4-methylcoumarin-6-carboxylate and its Methyl ether.

V. J. DALVI and SURESH SETHNA (Bombay)

Methyl 7-hydroxy-4-methylcoumarin-6-carboxylate has been brominated with one molecule of bromine when methyl 7-hydroxy-3-bromo-4-methylcoumarin-6-carboxylate has been obtained. This on methylation gave methyl 7-methoxy-3-bromo-4-methylcoumarin-6-carboxylate identical with the product obtained on bromination of methyl 7-methoxy-4-methylcoumarin-6-carboxylate. The bromo compound on hydrolysis gave an acid which does not contain any bromine.

Work on the bromination of the above ester and its methyl ether with excess of bromine and the bromination of methyl 5-hydroxy-4-methylcoumarin-6-carboxylate and its methyl ether is in progress.

107. Synthesis of Thioethers.

G. V. JADHAV and J. R. MERCHANT (Bombay)

Thionyl chloride is condensed with *o*-hydroxy acetophenone, resacetophenone, 2-hydroxy-4-methoxy acetophenone, 2-hydroxy-4-benzoyloxy acetophenone, 4-*o*-benzoyl resacetophenone and phloracetophenone in presence of finely divided copper, when 3:3'-diacetyl-4:4'-dihydroxy-diphenyl thioether, 3:3'-diacetyl-4:6:4':6'-tetrahydroxy-diphenyl thioether, 3:3'-diacetyl-4:4'-dihydroxy-6:6'-di-methoxy-diphenyl thioether, 3:3'-diacetyl-4:4'-dihydroxy-6:6'-dibenzoyloxy-diphenyl thioether, 3:3'-diacetyl-4:4'-dihydroxy-6:6'-dibenzoyloxy-diphenyl thioether and 3:3'-diacetyl-2:4:6:2':4':6'-hexahydroxy-diphenyl thioether are obtained. The constitution of these thioethers has been proved by nitration when known nitro derivatives are obtained, e.g., the thioether from resacetophenone gives 5-nitro-resacetophenone on nitration. The thioethers are also brominated under different conditions when bromo derivatives containing both sulphur and bromine, as well as bromo derivatives without sulphur are obtained. The action of sulphur monochloride and sulphur dichloride on the above ketones has also been studied. The work is further extended to 2-acetyl resorcinol and its derivatives.

108. Esterification of ortho and para orsellinic acids and phloroglucinol carboxylic acid.

P. R. SARAIYA and R. C. SHAH (Bombay)

Esterification of certain aromatic polyhydroxy acids which undergo decarboxylation readily cannot be carried out by the usual method of interaction with alcohols in the presence of sulphuric acid or hydrochloric acid. In the case of ortho and para orsellinic acids, only the methyl esters have been prepared by means of diazomethane.

However, by refluxing such acids in dry acetone with dialkylsulphate or dialkylhalide in presence of sodium or potassium bicarbonates under controlled conditions, it was possible to prepare such esters in good yield.

Thus, the methyl esters of the above acids and phloroglucinol carboxylic acid were prepared in 70-90% yield by refluxing for 8-12 hours with 1.25 moles of dimethyl sulphate and 1.5 moles of dry sodium or potassium bicarbonate. The ethyl esters of ortho and para orsellinic acids which have not been previously prepared from the acid were obtained in 70% yields by refluxing for 12 hours with 3 moles of ethyl iodide and 1.5 moles of sodium or potassium bicarbonate.

109. Addition products of anils and some metallic chlorides.

V. M. THAKOR and R. C. SHAH (Bombay)

Anils, from aniline, *o*- and *p*-toluidine, *o*-anisidine, etc., and β -ketonic esters, have been found to give well-defined crystalline addition products with zinc, mercuric and cadmium chlorides. Reference to literature reveals that no such addition products are known so far.

110. Condensation of butyl chloral hydrate with aromatic hydrocarbons and their halogen derivatives.

MISS L. H. DALAL and R. C. SHAH (Bombay)

$\alpha : \alpha : \beta$ -trichloro-*n*-butaldehyde hydrate was condensed with chlorobenzene with a view to obtain a compound of possible insecticidal activity. This compound was proved to be $\alpha : \alpha$ -bis-(*p*-chlorophenyl)- $\beta : \beta : \gamma$ -trichloro-*n*-butane, by refluxing with alcoholic potassium hydroxide and oxidising the resulting compound to the diaryl ketone—*p* : *p'*-dichlorobenzophenone. Preliminary tests with this product have shown that it possesses a marked insecticidal activity.

Condensation products similar to that obtained in the condensation of $\alpha : \alpha : \beta$ -trichloro-*n*-butaldehyde hydrate and chlorobenzene were obtained in the condensation of benzene, bromobenzene and naphthalene with $\alpha : \alpha : \beta$ -trichloro-*n*-butaldehyde. In all these condensations two molecules of the hydrocarbon or halohydrocarbon have been found to take part.

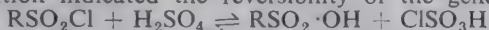
In the condensations of anisole and phenetole with $\alpha : \alpha : \beta$ -trichloro-*n*-butaldehyde, however, it has been found that only one molecule of the phenolic ethers takes part in the reaction, mono-condensation products being obtained.

111. Equilibrium in the reaction between sulphonyl chlorides and sulphuric acid.

D. V. JOSHI and R. C. SHAH (Bombay)

That sulphuric acid has a decomposing action on sulphonyl chlorides, was observed for the first time by Shah and Kulkarni in this laboratory (Kulkarni, *M.Sc., thesis, Bom. Univ.*, 1944). This explained why large excess of chlorosulphonic acid is required in obtaining sulphonyl chlorides in good yields.

This observation indicated the reversibility of the general reaction:



In the present work the existence of equilibrium, above suggested, has been definitely experimentally established in the cases of benzene sulphonyl chloride and *p*-toluene sulphonyl chloride by studying the reactions from both the sides.

The decomposing action of 100% sulphuric acid on benzene sulphonyl chloride has also been studied at various temperatures and with different proportions and has been found to be increasing with the increase in temperature and proportion of the sulphuric acid.

112. Investigation of some methods of determining the glyceride composition of fats.

V. V. MHASKAR and B. V. BHIDE (Poona)

For the estimation of fully saturated glycerides in a fat, Hilditch and Lea (*J.C.S.*, 1927, 3106) developed a method which depends on the potassium permanganate oxidation of the fat in acetone solution. This method has been further extended for the estimation of fully saturated, diunsaturated and monounsaturated glycerides in a fat, by Kartha and Menon (*Proc. Ind. Acad. Sci.*, 1943, 17A, 114).

In the present work the method has been tested by preparing synthetic fats of known glyceride composition and analysing them according to Kartha and Menon's procedure (*loc. cit.*). A mixture of tristearin, triolein, oleo-distearin and dioleostearin was prepared and analysed. The results indicate that the method is reliable within certain limitations which are discussed.

113. Studies in the chemistry of chromones—Part I. 6-hydroxy chromones.

T. R. INGLE and N. L. PHALNIKAR (Poona)

The preparation of 6-hydroxy substituted chromones seemed to be of interest as very few of them are known and are synthesised.

By the interaction of 2 acyl hydroquinones, ethyl formate and sodium, the following 6 hydroxy-3-alkyl (aryl) chromones have been prepared.

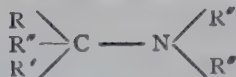
- (1) 6-hydroxy chromone, m.p. 241 (lit. 243), acetyl derivative, m.p. 126 (lit. 126). (methyl ether, m.p. 97–98).
- (2) 6-hydroxy-3-ethyl chromone, m.p. 180 (acetyl, m.p. 90; methyl ether m.p. 66).
- (3) 6-hydroxy-3-benzyl chromone, m.p. 226 (acetyl, m.p. 128).
- (4) 6-hydroxy-3-phenyl chromone (6 hydroxy isoflavone), m.p. 215, (acetyl, m.p. 152, methyl ether, m.p. 171).

Further work is in progress.

114. α -Amino (substituted) diphenyl methanes.

M. V. PATWARDHAN and N. L. PHALNIKAR (Poona)

Recently it has been shown that alkyl amines of the type



(Buu Hoi, *Nature*, 1945, **156**, 392) have antitubercular properties (*cf.* Massie, Iowa State College, *J. Sci.*, 1946, **21**, 41); Borrows *et al.*, *J.C.S.*, 1947, 197).

We have prepared similar amines but with substituted phenyl groups in place of R in the above formula. A series of α -amino substituted diphenyl methanes (substituents, OCH₃, Cl, Br in one or both the phenyl groups) have been prepared and characterised by suitable derivatives, by the reduction of the corresponding substituted benzophenone oximes.

The antibacterial properties of these compounds are being studied.

115. Azo dyes from Sulpha drugs and naturally occurring quinone colouring matters.

N. L. PHALNIKAR (Poona)

Embellin, 2 : 5-dihydroxy-3-undecyl-*p*-benzoquinone (Nargund and Bhide, *J. Ind. Chem. Soc.*, 1930, **8**, 237; Asano and Yamaguti, *J. Pharm. Soc. (Japan)*, 1940, **60**, 36) is a naturally occurring quinone. It has been coupled with diazo salts from various sulpha drugs such as sulphanamide, sulphapyridine, sulphathiazole, sulphapyrimidine, etc. The resulting azo dyes are dark red coloured substances, having very high melting points.

Similar azo dyes are being prepared from other naturally occurring quinones such as lawsone, juglone, etc.

The antibacterial properties of these azo dyes are being studied.

116. Synthesis of α -Alkyl tricarbyllic acids.

N. L. PHALNIKAR (Poona)

Agaricic acid is supposed to have antitubercular properties (Roberts *Nature*, 1945, **155**, 698). Agaricic acid is cetyl citric acid, or α -cetyl- β -hydroxy tricarbyllic acid. As attempts at the synthesis of agaricic acid have so far failed, it was thought that simpler α -alkyl tricarbyllic acids might be synthesised and their antibacterial properties might be studied. Hence a series of α -alkyl tricarbyllic acids (alkyl group = propyl, *n*-butyl, isoamyl, *n*-hexyl, iso-octyl, cyclohexyl, etc.) have been synthesised by the Michael reaction between dimethyl maleate and diethyl alkyl malonates. The α -alkyl tricarbyllic acids, obtained by acid hydrolysis, have been characterised by suitable derivatives.

The acids are being tested for their antibacterial properties.

117. Chemical Investigation of *Hippocratea indica* (Willd.) (N.O. Celastraceæ).

N. L. PHALNIKAR (Poona)

The investigation of this plant was undertaken at the suggestion of the Forest Utilisation Officer, Government of Bombay, Bombay.

The plant, *Hippocratea indica*, is found widely distributed in South Canara Districts of the Bombay Presidency, where it is known as 'Kangana Bally'. It is also reported that a decoction of the bark of the plant is used successfully for pneumonia. The bark and roots of the plant were, therefore, subjected to chemical analysis.

The alcohol extracts of the roots and the bark gave a substance, m.p. 187, which has been identified as dulcitol by its analysis and acetyl derivative (m.p. 169) and oxidation to mucic acid (m.p. 212–213).

A colouring matter has been also isolated and is under investigation.

118. A new glucoside from *Hydrocotyle asiatica* Linn. (N.O. Umbelliferæ).

N. L. PHALNIKAR (Poona)

Recently it has been reported that a glucoside, Asiaticoside (m.p. 232, mol. wt., 415, $[\alpha]_D = -15.73$ in 60% ethyl alcohol from *Hydrocotyle asiatica*, N. O. Umbelliferæ (Bontemps, *Bull. Sci., Pharmacol.*, 1941, **49**, 186) is an effective remedy against leprosy.

In the present work a new glucoside has been isolated from the plant collected from the neighbourhood of Poona, by extraction of the plant with alcohol. On purification, it crystallised from alcohol in cubes and had m.p. 284 with decomposition (mol. wt., 732, 742 (cryscopic, solvent alcohol) $[\alpha]_D = -32$ in absolute alcohol). From the analysis and using the above mol. wt., the molecular formula of the new glucoside comes out to be $C_{40}H_{68}O_{10}$. On hydrolysis with concentrated hydrochloric acid it gave a reducing sugar and an aglucone, giving the characteristic reactions of sterols. Further work is in progress.

Dr. Dharmendra, of the School of Tropical Medicine, Calcutta, reports that this glucoside has no action on M. Tuberculosis even in a concentration of 20 mgms. per 100 c.c.

119. A new synthesis of Cadalene.

SUKH DEV and P. C. GUHA (Bangalore)

Cadalene, the important dehydrogenation product of some of the sesquiterpenes, was originally synthesised by Ruzicka and Seidel (*Helv. Chim. Acta.*,

1922, 5, 369) by a comparatively lengthy procedure. A new and much simpler procedure for its synthesis has been achieved.

p-Cymene was condensed with methyl succinic anhydride in presence of anhydrous aluminium chloride to give α -methyl- β -(*p*-cymoyl-2)-propionic acid, m.p. 118–119°, the structure of which has been established by a straight forward synthesis, starting from 2-acetyl-*p*-cymene.

The keto-acid was reduced by Clemmensen's method using Martin's modification (*J. Amer. Chem. Soc.*, 1936, 58, 1438), yielding a colourless slightly viscous liquid, b.p., 182–85°/6 mm. The β -methyl, γ -(*p*-cymyl-2)-butyric acid was cyclised with aluminium chloride, *via.*, the acid chloride to yield the corresponding tetralone, b.p. 136–138°/2 mm. The tetralone was reduced with sodium in moist benzene to give the secondary alcohol which was dehydrated with anhydrous formic acid. The resulting hydrocarbon, b.p. 132–138°/9 mm. was completely aromatised by dehydrogenation with selenium to give 1:6-dimethyl-4-isopropyl-naphthalene or cadalene.

120. The Cyanine dyes of the Pyridine Series—Part VI.

M. Q. DOJA and KAILASH BIHARI PRASAD (Patna)

The influence of the presence of several *p*-dialkyl-amino-styryl groups on the sensitising power of a cyanine dye, has been studied. A new type of cyanine dye has been synthesised and examined, by the condensation of collidine methiodide with *p*-dimethyl—and *p*-diethyl aminobenzaldehyde.

121. Synthesis of Cyanine dyes by the condensation of *p*-di-ethyl-amino-benzaldehyde with appropriate heterocyclic compounds—Part IV.

M. Q. DOJA and JOGESHA CHANDRA BANERJI (Patna)

Four new dyes have been synthesised by the condensation of *p*-di-ethyl-amino-benzaldehyde with 6-chloro-6-bromo, 6-methoxy-, 6-ethoxy-2-methyl benzothiazole-methiodides in absolute alcohol medium using piperidine as catalyst.

Their absorption spectra, sensitisation spectra and other properties have been studied.

122. Studies in Sulphonamides: Action of alkyl and aryl amine on benzene-1:4-disulphonyl chloride.

M. RAGHAVAN, B. H. IYER and P. C. GUHA (Bangalore)

In view of the increasing importance of sulphonamide type of compounds in chemotherapy, it was thought desirable to prepare a series of disulphonamides of the general formula $R \cdot NH \cdot SO_2 \cdot C_6H_4 \cdot SO_2 \cdot NH \cdot R$, (para) where R is aryl or alkyl residue, and test the pharmacological activity of the compounds.

The action of benzene-1:4-disulphonyl chloride prepared according to the method of Drushel and Felty (*Amer. J. Sci.*, 1917, 43, 57) on the following 24 amines has been studied and the products of reaction isolated and characterised. The amines used are methyl, ethyl, 2-pentyl, and isopropylpropylamines, ortho and para toluidines, ortho, meta and para xylidines, para-anisidine, *p*-phenetidine, *o*- and *p*-chloranilines, *m*-bromaniline, α and β naphthylamines, *p*-phenylenediamine, benzidine, *o*-tolidine, α -aminopyridine, diaminodiphenyl sulphide and sulphone and phenyl hydrazine. The reaction was conducted in benzene and the products were crystallised from alcohol, acetone or water. All the products are soluble in dilute alkali. The therapeutic properties of these compounds are under investigation.

123. Action of aromatic hydroxy compounds on benzene-1 : 4-disulphonyl chloride.

M. RAGHAVAN, B. H. IYER and P. C. GUHA (Bangalore)

Carr and Brown (*J. Amer. Chem. Soc.*, 1947, **69**, 1170) have synthesised some *p*-alkoxybenzenesulphonic acid esters as possible local anæsthetics by reacting alkoxybenzenesulphonyl chloride with aliphatic alcohols (*cf.* Sen, *J. Ind. Chem. Soc.*, 1946, **23**, 383). With a view to study the pharmacological properties of benzene (1 : 4) disulphonyl esters, benzene-1 : 4-disulphonyl chloride has been reacted with 11 aromatic hydroxy compounds in acetone solution in the presence of sodium carbonate and the resulting sulphonyl esters have been isolated and characterised. The hydroxy compounds used are phenol, *o*- and *p*-nitrophenol, 2 : 4-dinitrophenol, *o*- and *p*-chlorophenols, *m*- and *p*-cresols, α and β naphthols and methone. Some of the reactions were repeated in presence of diethylaniline but the products were identical with the esters mentioned above. All the disulphonyl esters are crystalline compounds with definite melting points. The therapeutic properties of these compounds are under investigation.

124. Organo-arsenicals: Sulphonyl Esters of Hydroxyphenyl-arsonic Acids.

A. C. ROY, B. H. IYER and P. C. GUHA (Bangalore)

A number of arylsulphonamides have been prepared by the action of arylsulphonyl chloride on aminophenylarsonic acids and tested pharmacologically (Hewitt, King and Murch, *J.C.S.*, 1926, 1365). A survey of the literature showed that very little study has been made of the compounds expected to be formed by the action of arylsulphonyl chlorides on hydroxyphenylarsonic acids.

Nineteen sulphonyl esters of the general formula $R \cdot C_6H_4 \cdot SO_2O \cdot C_6H_3 \cdot R^1$. AsO_3H_2 have now been prepared by the action of (i) benzene-, (ii) *p*-toluene-, (iii) *p*-chlorophenyl-, (iv) *p*-acetaminophenyl-, (v) β -naphthalene-, sulphochlorides on (a) 4-hydroxy-, (b) 3-nitro-4-hydroxy-, (c) 3-acetamino-4-hydroxy-, phenyl-arsonic acids, and characterised. They are under pharmacological examination. Some of these esters have been reduced to the corresponding arseno-compounds.

125. Studies in Rosin: Destructive Distillation of the Rosin from *Pinus excelsa*.

I. S. PATEL, B. H. IYER and P. C. GUHA (Bangalore)

The rosin from *Pinus excelsa* has been submitted to destructive distillation and a preliminary study of the gaseous and liquid products has been made. The gases evolved during distillation consist of carbon dioxide (64.1%), carbon monoxide (9.3%), oxygen (3.7%), hydrogen (7.0%), saturated hydrocarbons (13.0%), unsaturated hydrocarbons (2.9%). The crude distillate (75% on the weight of rosin) boiling from 80°-400° C. at ordinary pressure was collected into six primary fractions, which were further fractionated by redistillation at ordinary and reduced pressures. The physical constants like specific gravity, refractive index, optical rotation and viscosity of each of the fractions have been determined. Further work on the isolation and characterisation of individual compounds is in progress.

126. Studies in Antimalarials: Some Biguanide Derivatives.

H. L. BAM, B. H. IYER and P. C. GUHA (Bangalore)

In continuation of the work on the synthesis of substituted biguanide derivatives as possible antimalarials (Bami, Iyer and Guha, *J. Indian Inst.*

Sci., 1946, **29 A**, 1; *Indem, Curr. Sci.* 1947, **16**, 252, 254) some more compounds of this type have been prepared in order to test their antimalarial activity against avian malaria.

2:4-Dichlorophenylcyanoguanidine has been prepared by denitrogenating the azo-dye obtained after reacting 2:4-dichlorophenyldiazonium chloride with dicyandiamide, and reacted with hydrochlorides of dimethylamine, isoamyl amine and isopropyl amine to give N¹-2:4-dichlorophenyl-N⁵-alkylbiguanide hydrochlorides.

Phenylcyanoguanidine has been reacted with 6-methoxy-2-aminobenzothiazole hydrochloride to give N¹-phenyl-N⁵-6-methoxy-2-benzothiazolylbiguanide hydrochloride. Further work on the synthesis of compounds of these two groups is in progress.

127. Denitrogenation of Arylazocyanoguanidines.

H. L. BAMBI, B. H. IYER and P. C. GUHA (Bangalore)

With the discovery of antimalarial action of substituted biguanide derivatives (Curd and Rose, *J.C.S.*, 1946, 729) and further work on similar lines (Bami, Iyer and Guha, *J. Indian Inst. Sci.*, 1946, **29 A**, 1; *Curr. Sci.*, 1947, **16**, 252), it is required to synthesise various substituted arylcyanoguanidines as important intermediates. These compounds have been previously reported by Walther and Greeshiemer [*J. fur. Prakt. Chem.*, 1915, **19** (ii), 218] and Wheeler and Jamieson (*J. Amer. Chem. Soc.*, 1903, **25**, 719), Walther and Greeshiemer's method has now been modified, extended and improved.

Curd and Rose (*loc. cit.*) have denitrogenated the triazines in a mixture of β -ethoxy-ethanol and hydrochloric acid, while we have denitrogenated *p*-chlorophenylazocyanoguanidines and similar other *p*-substituted phenylazocyanoguanidines in a mixture of any of the following solvents and acids at 30°–40° in about an hour:

Solvents.—Formic acid, acetic acid, acetone, methyl-ethyl-ketone, diethylketone, ethylene-chlorohydrin, methyl alcohol, ethyl alcohol propyl alcohol and dioxan.

Acids.—Hydrochloric acid, hydrobromic acid, acetic acid, sulphuric acid and nitric acid.

It seems that the formation of a labile hydrochloride of the triazines is necessary, because it has not been possible to denitrogenate them by other methods without the use of acids. Failure to denitrogenate *p*-sulphamylphenylazocyanoguanidine also points towards a similar mechanism of reaction for such denitrogenations.

128. Studies in Antimalarials—Part I. Synthesis of some Methoxy-benzothiazole-carbamides.

P. C. GUHA and J. R. GUHA (Bangalore)

It has been found by workers in the domain of antimalarial drugs that compounds are most active when the methoxy group is in the position 6 of the quinoline ring and the nuclear nitrogen in the para-position to the methoxy group. Hence it was thought that compounds obtained by condensing various side chains to 2-amino-6-methoxy-benzothiazole may possess antimalarial properties, as benzothiazole may be considered as a quinoline ring in which two CH groups are replaced by a sulphur atom. The following urea and substituted urea derivatives of methoxy-benzothiazole have been synthesised:

1. R.NH.CO.NH₂, m.p. 330° (decomp.).
2. R.NH.CO.NH.Ph, m.p. 240°.
3. R.NH.CO.NH.C₆H₄.OMe (*o*), m.p. 181°.
4. R.NH.CO.NH.C₆H₄.OCH₃ (*p*), m.p. 260°.
5. R.NH.CO.NH.C₆H₄.CH₃ (*p*), m.p. 236°.
6. R.NH.CO.NH.C₆H₄.Me (*o*), m.p. 252°.

(R = 2-amino-6-methoxybenzothiazolyl)

129. Studies in Antimalarials—Part II. Synthesis of some 5-substituted thioureas and guanidines of 2-chloro-7-methoxy acridine.

P. C. GUHA and J. R. GUHA (Bangalore)

2 : 5-Dichloro-7-methoxy acridine is an essential starting material for the preparation of Atebrin. Guha and Mukherjee (*J. Indian Inst. Sci.*, 1946, **28 A**, Part IV, 70) prepared 5-diethyl-aminoisopentyl-substituted semicarbazido, thiosemicarbazido, hydrazino derivatives of 2-chloro-7-methoxy acridine compounds.

In the present paper is described the preparation of methyl, ethyl, phenyl, *o*- and *p*-methoxyphenyl, *o*- and *p*-tolyl, thiocarbamido derivatives of 2-chloro-7-methoxy-5-amino acridine. They have been prepared by the action of substituted thioureas with the 5-amino acridine compound ($R = \text{methyl}$, m.p. 278–79°; ethyl, m.p. 287–88°; phenyl, m.p. 276–78°; *o*-methoxy, m.p. 282–84°; *p*-methoxy, m.p. 297–98°; *o*-tolyl, m.p. 293–94°; *p*-tolyl, m.p. 310–12°; *n*-propyl and *n*-butyl derivatives did not melt even at 360°.

Work is in progress for the conversion of these thiocarbamido derivatives into guanidine compounds by treatment of the alkylthiolthiocarbamides with suitable alkyl, aryl and heterocyclic amines.

130. Studies in Isolation, Estimation and Preparation of Derivatives of Cellulose.

P. S. VARMA and ABHAYA SINHA (Benares)

Cellulosic raw materials including bamboo, cotton waste, jute, hemp, flax, filter paper-cuttings, and cotton mill waste (broken, knotted threads, etc.) have been examined with a view to find out their cellulose contents and their suitability for the manufacture of synthetic fibres.

The α and β cellulose have been determined gravimetrically and the γ cellulose volumetrically. In some cases the γ portion has been found to exceed the β fraction.

Di- and Tri-acetyl, benzoyl and phthalate derivatives have been prepared and their properties examined. The acyl groups estimated quantitatively by the volumetric method—Eberstadt's method (*Ind. and Eng. Chem. Analytical* edition, 1941, **13**, 369).

131. Chemical Examination of the Flowers of *Bignonia venesta*.

PRITHWI NATH BHARGAVA (Benares)

A new wax 'Venestan' (m.p. 66–79°) has been obtained from the benzene extract of the flowers of *Bignonia venesta*. It has been crystallised from methyl alcohol in brownish yellow flakes. Its saponification value has been found to be 141–47 and saponification equivalent, 378–96. As a result of hydrolysis some ceryl alcohol (m.p. 78°) and palmitic acid (m.p. 63°) have been isolated along with a minute quantity of the unsaponifiable matter which has been found to give Liebermann-Burchard's and Salkowski's colour reactions and hence showing the nature of a phytosterol. The work on the 'Phytosterol' is in progress.

132. Halogenation—Part XXXXI. Direct Bromination of Aromatic Ketones.

P. S. VARMA and SATYENDRA VARMA (Benares)

In continuation of previous work (*Proc. Ind. Sci. Congress*, 1947) in which it was shown that some aromatic ketones could be directly iodinated and iodo-derivatives obtained by the methods of Varma and Panicker (*J.I.C.S.*, 1926,

3, 342), direct bromination of acetophenone, benzophenone, *p*-hydroxybenzophenone, *p*-methoxybenzophenone, *p*-aminobenzophenone, 4:4'-diaminobenzophenone, 4:4'-tetramethyl diaminobenzophenone, benzoin, benzil and anthraquinone have been carried on under similar conditions and good yield of bromo-derivatives obtained and some of them for the first time by direct bromination.

133. The characteristics and composition of vegetable fats in relation to the habit of the plant—Papilionaceæ family—Part II.

M. NARASINGA RAO and R. SUBBIAH (Waltair and Vizagapatam)

Characteristics and composition of seeds from six members of the Papilionaceæ family, namely: (1) *Erythrina Indica*, (2) *Pongamia glabra*, (3) *Sesbania grandiflora*, (4) *Arachis*, (5) *Psoralea corylifolia*, (6) *Trigonella fennugræcum* are examined critically and their relationship to the stature of the plant has been ascertained.

That the oils from seeds derived from trees are more saturated than those derived from herbs or shrubs within the close cycles of affinity has been observed in a previous paper in which the members of the Malvascæ family were chosen for examination. Herein, Papilionaceæ family, the members of which yield oil-bearing seeds is examined to find out the relationship between the habit of the plant and the characteristics and composition of the oil of its seeds.

134. Studies on Fries rearrangement.

A. B. SEN and V. S. MISRA (Lucknow)

In the present paper, Fries rearrangement has been studied for the first time, in the case of purely unsaturated aliphatic acids. A number of phenolic esters of Oleic and LB Hexenic acids have been prepared and their rearrangement on treatment with anhydrous aluminium chloride studied.

Oleic acid esters failed to give identifiable rearrangement products whereas six esters of Hexenic acid with phenol, *o*, *m* and *p*-cresol, Resorcinol mono-methyl-ether and hydroquinone mono-methyl-ether have been obtained. In the case of oleic acid however, only three esters, viz., *o*, *m* and *p*-cresol oleate, have been prepared.

The LB Hexenic acid has been characterised by the preparation of the chloride and the amide.

Only the phenyl and *o*-cresyl esters, of Hexenic acid yielded a mixture of *o*- and *p*-hydroxyketones after the rearrangement, whereas the remaining esters formed exclusively the ortho-hydroxyketones. The ortho-hydroxyketones have been characterised by the preparation of their 2:4 dinitro phenyl hydrazones and the para-hydroxyketones through their benzoyl derivatives.

135. Search for new Insecticides allied to DDT—Part I.

A. B. SEN and P. M. BHARGAVA (Lucknow)

Two theories have been put forward concerning the remarkable insecticidal powers of dichloro-diphenyl-trichloroethane (*Nature*, August 11, 1945). One postulates that the toxic component is the linked *p*-chloro-benzene rings, while the chloroformic residue $-CCl_3$ imparts lipid solubility (Lauger, Martin and Muller, *Helvetica Chim. Acta.*, 1944, 27, 892). According to the other theory the lipid solubility is attributed to the chlorobenzene rings, while the remainder of the molecule is responsible for toxicity by splitting of HCl at the vital centres (Martin and Wain, *Nature*, 1944, 154, 512.)

The authors have synthesised a number of new compounds containing these two groups which are jointly responsible for the insecticidal properties

of DDT, with a view to determine the more exact relationship between chemical constitution and insecticidal properties.

The following new compound have been synthesised by condensation of chloral with the Grignard compounds of *p*-chlorobromobenzene, *o*-chlorobromobenzene and 1, 2-dichloro 4-bromobenzene respectively:—

1, 1, 1-trichloro 2-hydroxy 2-*p*-chlorophenyl ethane—brilliant yellow-liquid, b.p.—196–98°/11 mm., with characteristic smell. Colour fades on keeping.

1, 1, 1-trichloro 2-hydroxy 2-*o*-chlorophenyl ethane—brilliant red liquid, b.p.—196–98°/7 mm., with sweet smell.

1, 1, 1-trichloro 2-hydroxy 2-*m*-dichlorophenyl ethane—orange red liquid, solidifying to needles on cooling in ice. The colour gets discharged on keeping for a few months. Characteristic smell, b.p.—55–57°/5 mm.

The insecticidal action and physical properties of the abovementioned compounds are under investigation.

Bromination of chlorobenzene—It has been found that the bromination of chlorobenzene without using CCl_4 as a diluting agent gives a theoretical yield of *o*-chlorobromobenzene, while if chlorobenzene is diluted with an equal volume of carbon tetrachloride, the bromination is less vigorous and a theoretical yield of *p*-chlorobromobenzene is obtained.

136. Search for new Insecticides allied to DDT—Part II.

A. B. SEN and P. M. BHARGAVA (Lucknow)

The following new compounds have been obtained by the Friedel-Crafts' reaction between trichloroacetyl chloride and chlorobenzene, *o*-dichlorobenzene and *p*-dichlorobenzene respectively:—

4-chloro 1-trichloroacetophenone—odourless black glistening plates from chloroform, insoluble in water, alcohol and ether, soluble in CHCl_3 and CCl_4 . Does not melt.

3, 4-dichloro-1-trichloroacetophenone—light brownish-red liquid with characteristic smell. The colour begins to deepen immediately and in the course of few hours turns deep violet. Characteristic smell. b.p.—84–86°/36 mm., 80–81°/28 mm. This is obtained in a higher proportion than the ortho-isomer.

2, 3-dichloro 1-trichloroacetophenone—brilliant yellow liquid turning dark reddish-brown in course of time, b.p.—99–101°/22 mm.

3, 6-dichloro 1-trichloroacetophenone—yellow liquid, darkening on-keeping. Characteristic smell, b.p.—120°/1 mm. *p*-dichlorobenzene is very soluble in this compound and the latter could be purified only after five fractional distillations in vacuum.

The insecticidal action and physical properties of these compounds are under investigation.

137. Search for new Insecticides allied to DDT—Part III.

A. B. SEN and P. M. BHARGAVA (Lucknow)

The following new compounds have been obtained by the direct condensation of trichloroacetyl chloride with the sodium salts of *p*-chlorophenol 2, 4-dichlorophenol and resorcinol respectively:—Ester of *p*-chlorophenol and trichloroacetyl chloride—light brownish-red liquid, b.p.—93–97°/2 mm., 95–100°/5 mm. Refractive index at 23°—1.5138.

Ester of *p*-chlorophenyl and trichloroacetyl chloride—light brownish-red liquid, b.p.—93–97°/2 mm., 95–100°/5 mm. Refractive index at 23°—1.5138.

Ester of 2, 4-dichlorophenol and trichloroacetyl chloride—colourless liquid which acquires a slightly brownish-tinge on keeping. Phenolic smell, b.p.—163°/0.5 mm., 167°/3 mm. Refractive index at 24°—1.5490.

Ester of resorcinol (both -OH groups substituted) and trichloroacetyl chloride—colourless liquid with characteristic smell, b.p.—95°/5 mm.

The insecticidal action and physical properties of these compounds are under investigation.

138. Studies in Indigoid Dyes—Part V.

SISIR KUMAR GUHA (Patna)

In continuation of the work of Guha (*J. Indian Chem. Soc.*, 1935, **12**, 659; 1937, **14**, 709; 1938, **15**, 359, 1944, **21**, 391) on the studies of the influence of a methyl radical in the various available positions of the thionaphthene nucleus of bis-2-thionaphthene-ethylene-indigo, 2-thionaphthene-1'-aceanthrylene-indigo, benzylidene-2-thionaphthene and its *p*-nitro-, and *p*-dimethyl-amino derivative, the present investigation was undertaken.

7-chloro-2-hydroxy-thionaphthene (Dolgliesh and Mann, *J.C.S.*, 1945, 893) has now been condensed with glyoxal, aceanthrene-quinone, benzaldehyde, *p*-nitro-, and *p*-dimethyl-aminobenzaldehyde. The new substances are all beautiful crystalline coloured compounds. The dyeing shades on wool, obtained from all the products from an acid bath, have been fully and uniformly developed and those on cotton from the hydrosulphite vat have also been developed well in the case of bis-2-(7-chloro) thionaphthene-ethylene-indigo and 2-(7-chloro) thionaphthene-1'-aceanthrylene-indigo only.

139. Chemical Examination of the Nim Leaves (*Melia azadirachta*).

CHITTARANJAN MITRA AND SALIMUZZAMAN SIDDIQUI (Delhi).

As an extension of the work carried out on the Nim seeds (*Curr. Sci.*, 1942, 278; *J.S.I.R.*, 1945, **4**, 5), blossoms (*J.S.I.R.*, 1947, **6 B**, 19) and the root bark (*Proc. Ind. Sci. Cong.*, 1947), the leaves of the plant which are widely used for various skin affections, for the healing of unhealthy wounds and ulcers and also as a febrifuge, were taken up for investigation. Mature leaves collected locally in March were crushed after partially drying in shade and successively percolated with ether and then alcohol. The petrol ether insoluble fraction of the ethereal extractive yielded a water-insoluble amorphous bitter of an acidic character, melting at 90–110° C., (yield, 0.6 per cent. on the weight of the fresh leaves). The petrol-ether soluble fraction of the ethereal extractive yielded a sterol which did not show any depression in its melting point (137° C.) on admixture with nimbosterol (m.p. 137° C.) (*loc. cit.*). The carotenes present in this fraction could be separated from the sterol chromatographically. From the alcoholic extractive of the leaves an amorphous brown acidic product, soluble in hot water, has been obtained through its lead salt (yield, 0.2 per cent.). Further work is in progress.

140. Mechanism of Monomolecular Reactions.

B. PRASAD (Cuttack)

The simple Lindemann mechanism is defective as it postulates that the net rate of activation by collision is proportional to the concentration of active molecules. It has been suggested that the net rate of activation should be proportional to the difference between the theoretical and the actual concentration of active molecules. With this assumption it has been shown that if a molecule decomposes some time after activation the velocity constant would correspond to a unimolecular reaction if the concentration is not very low. At lower concentration the velocity constant would decrease and at still lower concentration when all the activated molecules will have a chance of decomposing before they are deactivated, the reaction would become bimolecular.

141. Chemical Investigation of the Seeds of *Adenanthera pavonina* Linn.

C. S. PATEL, C. C. SHAH and H. P. PARIKH (Baroda)

Seeds of the deciduous tree *Adenanthera pavonina* Linn. are used in India for medicinal purposes. Oil from these seeds has been analysed and found

to have sp. gr. 0.92, ref. index at 40° C. 1.477, acid value 2.43, sapon. value 190, iodine value 95.3, unsapon. matter 1.08%, Polenske value 0.77, Reichert-Meissl value 1.21. The alcoholic extract of the seeds contains a compound melting at 34° C. and is suspected to have an alkaloid.

Further work is in progress.

Biochemistry

142. Preparation of Amylose from Unmodified Starch.

P. N. JOSHI and K. V. GIRI (Bangalore)

A new method for obtaining amylose (a slight modification of Mac Cardy and Hassids method) has been standardised. The starch is leached out just below its gelatinisation temperature, and the extract is collected by centrifuging. To the clean extract, enough ethanol is added to give 40% concentration of ethanol by volume. Amylose gets itself precipitated within two or three days. This preparation is compared to the one obtained with Thymol as a precipitant. The extent of retrogradation, the kinetics of enzymic hydrolysis, and other factors have been studied.

143. Agar plate method for differentiation of various starch fractions.

P. N. JOSHI (Bangalore)

A method to distinguish between cereal and tuber starches as well as various amylolytic enzymes by using agar plate, as suggested by Giri was further extended to various starch fractions. A suitable explanation based on the differential rates of hydrolysis of the two fractions by various enzymes has been suggested to explain all the colour patterns.

144. Studies in the Fractionation of Soluble Starch.

P. N. JOSHI and K. V. GIRI (Bangalore)

Various methods of fractionation of starch were studied. It was possible to obtain amylose, amylopectin, and some other dextrin-like fractions in reasonably good yield. It was found that amylopectin and amylose were precipitated together, when fractionally precipitated with the precipitating solvents.

Even the so-called specific solvents gave a mixture of amylose and amylopectin. Suitable methods have been developed for the preparation of the two fractions. In the light of the above observations, the specific character of the above solvents, the inadequacy of the various methods used for determining and obtaining amylose, the heterogeneous character of amylose and amylopectin, and the mechanism of solubilisation are discussed in the paper.

145. Varietal Differences in Amylose and Amylopectin Contents of Rice Starch and their influence on the Quality of the Cereal.

A. R. VASUDEVA MURTHY, R. S. SUBRAMANYA and B. SANJIVA RAO
(Bangalore)

The amylose and amylopectin contents of starch from twenty different varieties of rice were determined by the potentiometric titration method of Bates, as modified by Schoch. The swelling numbers of these varieties were determined by the method described by B. S. Rao (10th International Congress of Chemistry, Rome, 1938). A close correlation was found to exist between

the swelling number of a rice and the amylose content of its starch. Starch having 17% amylose was present in varieties of rice with superior cooking quality. Rice of poor cooking quality was found to have starch of low amylose content. A few varieties of rice had no amylose at all in their starch. Parboiling did not alter the amylose content of rice starch.

146. Studies on Groundnut Oil.

K. RAMA MURTI and B. N. BANERJEE (Bangalore)

A random collection of 25 samples of groundnut oil in Bangalore showed that the f.f.A. varied from 1 to 7% with an average from 3 to 4%. Generally, a deeper colour and flavour also indicates higher f.f.A., but the relationship is not directly proportional. Except in hydrogenation factories, the f.f.A. is not considered harmful. There are no limits of f.f.A. to debar consumption as human food though it is well known that rancid fats and oils destroy vitamins in the food and delay digestion and absorption. Ghani or Chekku oil is slightly better than expeller oil. Broken, mouldy and shrivelled grains raise the acidity of the oil 3 to 4 times. Roasting or steaming of the kernels before extraction of the oil nearly doubles the f.f.A. of the oil. The processes of neutralisation, clarification and decolourisation of the oil, improve the quality of the oil but not its storage quality. By careful screening and separation of broken, mouldy, and shrivelled kernels from healthy full size seeds, acidity below 1% can be obtained. Such an oil stores 3 to 5 times better than mixed oil from the same batch of seeds. While refining reduces the acidity below 0.2% acidity, it does not improve storage property. The natural anti-oxidant or inhibitor present in the seed is destroyed and f.f.A. increases on storage. Groundnut oil (unrefined, raw) with f.f.A. below 1% is the best for edible purposes. Oils of higher acidity should be earmarked for industrial purposes only.

147. Component Fatty Acids of Goat Milk Fat from Kathiawar.

SOMA KUMAR and B. N. BANERJEE (Bangalore)

A sample of goat-milk fat from Veraval (Junagadh, Kathiawar) has been analysed. On comparison with similar analyses, the effect of cottonseed feed is evident. A lower R.M. and high iodine value characteristic of cottonseed feed on cow and buffalo milk fat are observed. The results are interesting in that they confirm the data used for distinguishing, genuine cottonseed-area ghee from adulterated ghee.

148. The Composition of Papaya and Gooseberry Pectins.

C. R. KRISHNAMURTI and K. V. GIRI (Bangalore)

Pectins prepared from papaya (*Carica papaya*) and gooseberry (*Phyllanthus emblica*) by acid and ammonium oxalate extractions, were purified by dialysis, oxidation by bromine water and repeated precipitation with alcohol. The ash-free pectins were subjected to acid hydrolysis. Galactose and arabinose were identified in the hydrolysates. *d*-Galacturonic acid, the basal unit of pectic acid was isolated from barium galacturonate. From the yields of furfuraldehyde, mucic acid and the barium contents of barium galacturonates and barium pectates the structural units of the two pectins were calculated and were found to conform to the Nanji, Paton and Ling formula, consisting of 4 galacturonic acids, 1 of arabinose and 1 of galactose.

149. Prototropy and Antimalarial Activity.

U. P. BASU (Baranagar, Calcutta)

Different types of compounds—quinolines, acridines, guanidines, sulpho-
namides,—are now known to exert a chemotherapeutic action against malarial

parasites. Their behaviour against the plasmodium and the changes involved in their molecule tends to establish the fact that the activity of antimalarial drugs is derived from their ability to participate in an essential biological system of the parasite.

It is known that enzymatic reactions are virtually chemical in nature and would depend much on the mobility of the compound available for therapeutic action. The presence, or, the formation of a structure that allows prototropy for the existence of a mobile conjugated system seems to be responsible for the activity of a compound against malarial parasites. The sulphonamides and guanidines may belong to the former and the quinolines and acridines to the latter category. Sulphadiazine, mepacrine and quinoline are found to act through different mechanism. In the case of quinoline derivatives, only those that allow prototropic change for the formation of quinonoid structure, are active.

150. On the Determination of Arsenic in Pharmacopœial Arsenicals.

N. RAY and S. N. MITRA (Baranagar, Calcutta)

Various arsenical drugs are now used in clinical practice, but no single method has been fixed up for standardisation of their arsenic content. The method for arspenamine as has been adopted in U.S.P. XII is often followed in determining the common pharmacopœial arsenicals but it is not suitable for sodium cacodylate. Further, it requires hydrogen peroxide which is not always available in standard quality.

In the present paper, methods of determining arsenic have been discussed. In the course of this work it has been shown that the U.S.P. XII Arspenamine method may be followed in determining arsenic in carbarsone, sulfarsphenamine and sodium arsanilate even by replacing hydrogen peroxide by sodium oxalate. But a better and easier method for the determination of arsenicals whether pentavalent or trivalent would be the A.O.A.C. method that requires less chemicals and gives a correct indication of the arsenic content.

151. The Volatile Fatty acid Contents of Glycerin.

S. BHATTACHARYA (Baranagar, Calcutta)

Glycerin is largely used in pharmaceutical industries and for dietetic purposes. But the glycerin must be very pure. Several tests have been laid down in B.P. and U.S.P. in order to ascertain the purity of glycerine. Various brands of this chemical are now available in the Indian market; but it is being noticed that one variety is superior to others in pharmaceutical preparations. The difference is being particularly noticed in the volatile fatty acid content. As there is no standard for the volatile fatty acid content of glycerine in any pharmacopœia, the cause and effect of its presence and the necessity of fixing its limit in pure glycerine have been discussed.

152. Nutritive Value of Travancore Fishes—Part I.

K. SADASIVAN PILLAI and N. S. VARIER (Trivandrum)

The nutritive value of the edible varieties of fish (indigenous to Travancore waters) with respect to their fat, protein and mineral contents is being determined as part of a dietetic survey. The present paper deals with the data obtained on the following six varieties: (1) *Arius sona* (Cat-fish), (2) *Thymus thynnus* (Tunny), (3) *Ophicephalus* sp., (4) *Lactarius* sp. (Butter Fish), (5) *Sphyrna acutipinnis*, (6) *Sciaena* sp.

Vitamins and trace elements are not determined in the present investigations.

153. Relation between toxicity and physical properties of anti-septics—Part I. Estimation of extremely dilute solutions of alkyl salicylic acids and *p*-alkyl phenols.

M. R. PAI, N. L. PHALNIKAR and B. V. BHIDE (Poona)

In an investigation carried out in this laboratory to correlate toxicity with physical properties of several alkyl salicylic acids and *p*-alkyl phenols, it was necessary to estimate accurately extremely dilute solutions of these substances in water. Usual volumetric procedure was found to be unreliable.

It was found, however, that potentiometric titrations could be carried out with advantage in the case of these substances and minute quantities of them could be estimated accurately.

Standard alkali was used for the potentiometric titration of the alkyl salicylic acids and brominating solution for that of alkyl phenols. The method has been checked by estimation of solutions of salicylic acids and phenols of known concentration.

154. Relation between toxicity and physical properties of anti-septics—Part II. Adsorption of alkyl salicylic acids and *p*-*n*-alkyl phenols.

M. R. PAI, N. L. PHALNIKAR and B. V. BHIDE (Poona)

The present communication deals with a study of the adsorption of alkyl salicylic acids and *p*-alkyl phenols on charcoal with a view to establish a relation between toxicity and adsorption.

The adsorption index ($1/n$) in Freundlich equation was expected to serve as a suitable function to represent adsorption but the Freundlich's isotherm has been found not to hold good accurately for the series of compounds studied.

The results are, however, discussed in relation to adsorption and the number of carbon atoms in the side chain.

155. Relation between toxicity and physical properties of anti-septics—Part III. Surface tension, adsorption solubility and toxicity of alkyl salicylic acids, alkyl phenols and alkyl resorcinols.

M. R. PAI, N. L. PHALNIKAR and B. V. BHIDE (Poona)

The physical properties such as surface tension, adsorption on casein and solubility of alkyl salicylic acids, alkyl phenols and alkyl resorcinols have been studied in the present work.

The toxicity of these compounds towards earthworms has been determined in aqueous solutions of equimolecular concentrations.

It has been shown that there is no relation between toxicity and ability of the members of a series to lower surface tension as also their adsorption by casein.

It has been found that adsorption plays a more important part in determining toxicities of the higher members of the series while there is no correlation between the lower members of the series. There is no parallelism between the water solubilities of the compounds and their toxicities.

It is, therefore, believed that probably the mechanism of bactericidal action of the higher members of the series which are sparingly soluble is quite different from the mechanism of the bactericidal action of the more soluble members of the series.

156. Tamarind seed Jellose: Fermentative Degradation.

P. S. RAO (Dehra Dun)

Tamarind seed jellose undergoes fermentative degradation in aqueous solution, yielding a hexasaccharide, which is composed of xylose, galactose and glucose. The sugar, which may be named Tamarindose, decomposes at 228–30° C. and has a specific rotation of 73·8°. Its acetate melts with decomposition at 172–74° C. and has a specific rotation of 41·2 in methyl alcoholic solution.

157. Progress of Proteolytic Digestion of Commercial Casein with Papain.

M. M. BISWAS (Calcutta)

Commercial casein of standard quality has been subjected to proteolytic digestion by papain at pH 5·0 in presence of sodium thiosulphate and 8-hydroxy quinoline. Conductometric titrations have been carried out with 20 c.c. of digestion mixture at certain intermediate stages of the enzyme reaction with N alkali. Corresponding pH values have also been recorded. Titration curves drawn from these data indicate that the capacity for H ion adsorption by the digestion mixture falls at first with the progress of proteolytic digestion. The ionic equilibrium in the reaction mixture is not materially changed during the period of digestion.

158. Standardisation of Indian Ox Bile by its Refractive Index.

U. P. BASU and N. RAY (Baranagar, Calcutta)

In the different slaughter houses of India more than 3·25 lakhs of cows and buffaloes are annually slaughtered. The determination of the refractive index and other physical properties of the bile collected from the gall bladders of the slaughtered animals (*cf.*, Basu *et al.*, *Ind. Med. Gaz.*, 1940, 75, 215) throughout the year indicates that about 25 per cent. of these animals do not yield bladders rich in good quality bile. The yield of cholic acid from better grade bladders is about 18 g. per litre while that from the lower grade bladders is not more than 6 g. per litre. On an average one litre of bile is available from four gall bladders. A considerable amount of bile can therefore be collected during the year to afford sodium tauroglycocholate and other bile acids and salts. It has been noticed that bile exhibiting a refractive index of 1·3410 or lower than this, is not suitable for economic utilisation. The question of renovation of the slaughter-houses, the method of utilisation of the bile and the amount of various products that are available, have been discussed in the paper.

159. On the Iodometric Estimation of Vitamin C in Pharmaceutical Preparations.

S. K. GANGULY (Baranagar, Calcutta)

Vitamin C is now being added to various pharmaceutical preparations containing syrup, alcohol and glycerin. The simple method of iodometric titration may be followed in assaying the vitamin C content of preparations made up with syrup, alcohol or glycerin. If vitamins A and D be present the above assay may also be followed, but the elixir should be adjusted to pH 0·02 to 0·08 with sulphuric acid and the double back titration method of Stevens (*Jour. Ind. Eng. Chem.*, 1938, 10, 269) should be adopted.

160. Ascorbic acid as an analytical reagent for Iron—A preliminary note.

E. K. NARAYANAN (Calcutta)

The quantitative estimation of iron in the presence of much invert sugar and phosphoric acid is beset with difficulties. The official process for the estimation of iron in pharmaceutical preparations such as Syrupus Ferri Phosphati and Syrupus Ferri Phosphati cum Quinina et Strychnina is to titrate the solution, after oxidising the iron to the ferric state, against standard titanous chloride solution using ammonium thiocyanate as an internal indicator. Due to the un-availability of titanous chloride an alternative process has been devised using ascorbic acid. The iron content of five standard preparations of Syrupus Ferri Phosphati cum Quinina et Strychnina estimated by the new method ranged from 90.2 to 104.4% of the theoretical value calculated from the formula, but these are within the range of variability allowed by B.P. for processing. Further work is planned to increase the agreement between duplicate titrations, which is only 5% at present.

161. Stabilisation of solutions of Calcium Gluconate for injection.

E. K. NARAYANAN (Calcutta)

Calcium gluconate which dissolves only to about 4% in water at atmospheric temperatures, is required by the medical profession in 10 and higher percentage concentrations. For achieving this end, either expensive brands of the compound which readily give solutions of high concentrations are employed or use is made of certain substances as stabilisers. The chemical background of the stabilisation is not explained in literature. A study has been made of the reaction of one such stabiliser, *viz.*, boric acid, with various polyhydroxy compounds such as sucrose, lactose, maltose, ascorbic acid, glucose, mannose and calcium gluconate and it has been found that the chemical influence, as shown by the acidity, does not bear any relationship with the richness of the compound in hydroxyl groups. Calcium gluconate, however, forms a highly acidic solution. The solubility of this compound in various concentrations of boric acid, the titratable acidity of the solutions in relation to their equivalence to the boric acid present and other aspects have been studied. The titre value to pH 8.2 is only slightly in excess of that required by a monobasic acid. The concentration of boric acid optimally profitable for making injections has been found to be 0.5%, when 8.0% of calcium gluconate dissolves by mere mixing at room temperature. Neutralisation of such a solution by calcium carbonate yields a solution therapeutically richer in calcium, within B.P. standards.

162. Preparation of Coir from dried Coconut Husks.

P. N. JOSHI and K. V. GIRI (Bangalore)

It is possible to obtain coir from dried coconut husks by treatment with steam under pressure. Coir, thus obtained, is however black and attempts were made to find out if the tannin-like constituents soluble in alcohol are responsible for the blackening of the coir. Treatment with 0.20% Hydrochloric acid solution prevents the blackening and at the same time helps in softening the husk. The effect of concentration of acid, the time of keeping, the nature of acid, and the temperature of reaction mixture on the process, were investigated.

Brown coir of good quality can be obtained by the above method.

163. Manufacture of Ultramarine Blue.

A. I. SUNDARA RAO and D. S. TANDON (Delhi)

The optimum conditions for the manufacture of ultramarine blue have been worked out. The samples obtained have been compared against the standard products obtained in the market—the 'pigment' value or 'blue' of the ultramarine being estimated by the time required to decolourise by a known amount of standard acid. Though this is a rough method it is a ready and the only qualitative method of estimating the amount of 'blue' or 'quality' of any sample. The time of decolourisation values, as measured in seconds, obtained for different samples are:—

Standard 67: Sample No. 1, 55; Sample No. 2, 90; Sample No. 3, 137.

Samples No. 1, 2 and 3 are all pure samples of ultramarine without any diluents such as gypsum, chalk, barytes, etc., which are generally used in commercial samples.

Experiments are in progress to use the indigenously occurring Kaolin, Bentonite and other naturally occurring earths for the manufacture of ultramarine.

164. Component Fatty Acids of Buffalo-Milk Fats.

D. R. DHINGRA and GANESH CHANDRA (Kanpur)

Component fatty acids of buffalo milk fats obtained from Punjab in early and late lactation periods have been examined and it is found that the milk fat of early lactation period contains butyric 2·61, Caproic 0·70, Caprylic 0·99, Capric 1·76, Lauric 8·04, Myristic 11·60, Palmitic 28·55, Stearic 9·14, Arachidic 4·31, Oleic 32·21 and non-saponifiable matter 0·09. The milk fat of late lactation period contains Butyric 2·08, Caproic 0·93, Caprylic 0·72, Capric 0·68, Lauric 4·27, Myristic 14·39, Palmitic 31·63, Stearic 5·45, Arachidic 2·02, Oleic 34·17, Linoleic 2·39, C_{20} – C_{22} 0·23, and non-saponifiables 0·04.

Ghee from early lactation period contains more butyric acid and other steam volatile acids (Butyric to Lauric) than that from late lactation period while the content of unsaturated acids is less in the former. Obviously, lower fatty acids and unsaturated acids seem to take the main part in the metabolism of milk fat and seem to be exchangeable in their functions, at different periods of lactation.

Ghee from early lactation milk possessed higher Reichert value and better buttery flavour than that from late lactation period.

Higher content of butyric acid in C.P. milk fat (analysed by Bhattaacharya and Hilditch) and lower percentage of lauric acid in it as compared with Punjab milk fats are unusual. From the content of the unsaturated acids and percentage of other acids in general it seems that C.P. milk fat resembles more, early lactation fat. Differences may be due to climatic differences (the temperature of C.P. is usually about 5 to 10° higher than that of North-West of Punjab in October) and some food differences. However, differences in component fatty acids are not very great.

Butter-fat of early lactation period is superior to that of late lactation period in respect of odour, flavour and fatty acid content.

Industrial Chemistry

165. Chemical Study of Mango Kernels (Tukhmi Dessi).

D. R. DHINGRA, S. N. KAPOOR and GANESH CHANDRA (Kanpur)

The kernels of Tukhmi (Dessi) mangoes contain Fat 10·7%, Starch 72·8%, Sugar 1·07%, Protein 9·5%, Tannins 0·11% and Ash 3·66% (1·3% potassium oxide, 0·28% sodium oxide and calcium, magnesium, iron and silica in small quantities). Ash does not contain any aluminium.

From the analysis it is concluded that they form a good substitute food-stuff for domestic animals as confirmed by Kehr. In small doses it can also be mixed with wheat flour for human consumption and it can solve to some extent the acute shortage of food.

The component fatty acids of mango kernel fat consist of Capric 0.15, Lauric 2.74, Myristic 5.07, Palmitic 11.2, Stearic 31.06, Arachidic 1.71, Oleic 43.83, Linoleic 4.13 and unsaponifiable matter 0.1. These results materially differ from those given by Godbole *et al.* (*J. Ind. Chem. Soc.* 1946, 23, 407).

The practicability of using the fat in the manufacture of soap is discussed. Uses for the meal are indicated.

166. A New Process for the Manufacture of Santonin.

S. K. SAHA (Calcutta)

A simple and economic method has been developed by which Santonin is prepared from *Artemisia maritima* on a commercial scale. *Artemisia* is mixed up with straw and thoroughly moistened with water and extracted with benzene in a Soxhlet. The extract is taken up with lime water and gives on treatment with hydrochloric acid crude Santonin. This is purified by treatment with dilute soda solution and finally recrystallised from dilute alcohol. Yield is 90-95%.

167. Investigations on Some Cellulose bearing Raw Materials (other than Cotton) for the Manufacture of Rayon.

M. G. KARNIK and D. L. SEN (Matunga, Bombay)

Cellulose bearing raw materials available in India were studied as possible sources for the manufacture of rayon and allied products. Pulps obtained in India by the Soda, Sulphate and Sulphite processes were tested for their alpha-cellulose and ash content, cuprammonium viscosity, solubility in 1% alkali, lustre, copper-number and other factors.

A new technique has been evolved to isolate cellulose from bagasse which is a potential source of cellulose having characteristics similar to the pulp used in the rayon manufacture.

Pulps from bamboos, reeds, bagasse, etc., were studied from the standpoint of viscose and cellophane production.

168. Manufacture of Stearic Acid from Indian Vegetable Fats (*Garcinia indica*).

C. J. DASA RAO (Waltair)

Commercial raw material for the manufacture of stearic acid is animal fat (Tallow) and the product obtained is always contaminated with other fatty acids. A method for the preparation of stearic acid from vegetable fats (*Garcinia Indica*) has been worked out and gives chemically pure stearic acid. It consists in hydrolysing the vegetable fat with alcoholic potash by refluxing for 3 to 5 hours. After the hydrolysis is complete the alcohol is distilled off and the soap suspended in water. The suspension is treated with the required quantity of sulphuric acid, the mixed fatty acids liberated are separated from the aqueous layer. The mixed acids are dissolved in the minimum quantity of hot 95% alcohol and allowed to cool. Pure stearic acid crystallises out leaving palmitic and liquid acids in solution.

The commercial possibilities of the process are being worked out.

169. On the Electrical Coagulation of Cane Juice Colloids.

D. N. GHOSH (Patna)

The present paper is a continuation of the work communicated previously (*Proc. Indian Science Congress*, 1947). The process has since been tried on a large scale in the Guraru Factory of the Gaya Sugar Mills Ltd. and a comparative study, of the economics and the various stages of the Electrical, Double Carbonation and Double Sulphitation processes for sugar making, has been made.

170. Dielectric Constants of Plastics.

S. K. K. JATKAR and B. R. Y. IYENGAR (Bangalore)

The dielectric constants and density data of polyvinyl chloride, polychloro styrene, glycol phthalate, polyvinyl chloroacetate, vulcanized rubber, methyl methacrylate polysiloxanes, 'w' hydroxy-decanoic acids, acetonitrile-ethyl acrylate copolymers and solutions of polyvinylchloride, methylmethacrylate, mono and polychloroprene, mono and polystyrene, acetyl-, benzyl- and nitro-celluloses have been quantitatively interpreted on the basis of molecular structure. The effect of plasticisers and solvents on the various polymers has been explained quantitatively.

171. Dielectric Constant of Cellulose.

S. K. K. JATKAR and D. S. SASTRY (Bangalore)

The high dielectric constant of cellulose has been quantitatively interpreted on the basis of the new equation to mean rotation of the cellobiose units in the same sense as in solid HCl, HBr and Camphor. The moment so calculated is the vector of two C-O links with bond moment of 1.75 D.

172. Dipole Moment of Cellulose Esters.

S. K. K. JATKAR and D. S. SASTRY (Bangalore)

The dipole moment for a cellobiose unit for different degrees of nitrated cellulose has been measured in the acetone, ethyl, butyl and amyl acetate esters at different temperatures and frequencies. The moments calculated either by the D.C.M. equation or by the new equation show highly anomalous variation of the moment with degree of nitration, reaching high values when odd number of the six hydroxyl groups of cellobiose gets nitrated and low values which are nearly the same as for the original cellulose, when an even number is nitrated. These results definitely support the cellobiose structure of cellulose, the esterification proceeding in the order 6, 6', 3, 3' and 2, 2'. Some of the middle stages are mixtures of lower and high esters, the corresponding HCOH groups being in transposition. A study of previous work on the dielectric constants of ethyl, benzyl, acetyl and palmityl cellulose on the basis of the newer theories confirms the above findings.

173. Optical Activity of Cellulose and its Esters.

S. K. K. JATKAR and D. S. SASTRY (Bangalore)

The optical activity of the different derivatives of cellulose goes hand in hand with the dielectric polarisation and dipole moments. The highly anomalous nature of the optical activity with different degrees of esterification and hydrolysis shows six steps and not three.

174. Tannic Acid a by-product in the manufacture of Caffeine from Tea-waste.

HARA GOPAL BISWAS (Calcutta)

A laboratory method for the preparation of pure tea-tannin has been described. The constitution of the tea-tannin has been briefly discussed. A method of recovery of tea-tannin suitable for the preparation of writing ink from a charge of tea-waste used in the manufacture of Caffeine has been given. Experiments are in progress for the recovery of tea-tannin from the exhausted mass of the usual methods of manufacture of Caffeine from tea-waste.

175. Preparation of Benzene Hexachloride or 666.

D. R. DHINGRA, S. N. KAPOOR and R. P. AGRAWAL
(Kanpur)

The paper gives in detail the method of preparation of pure gammexane from Benzene and Chlorine. Five isomers namely α , β , γ , δ and ϵ are formed out of which γ isomer is the most powerful insecticide against carpet beetles, cloth moth flies, silver fish and ants, etc. It contains 73% chlorine.

Gammexane is prepared by passing chlorine into a reaction mixture consisting of 10% caustic soda solution and benzene in presence of catalyst, e.g., antimony and mercury. The reaction mixture was continuously stirred and the temperature was kept at 20–25°C. The absorption of chlorine is most satisfactory when the reaction mixture is alkaline.

The authors have tried various catalysts and conclude that mercury either alone or in combination with antimony gives the best yields. Catalyst containing 4 of antimony to 1 of mercury gives the highest yield of γ isomers (19.4%) as compared with 12% so far reported.

Details of equipment and the cost of manufacture of Gammexane are given.

176. On the Manufacture of Potassium Chlorate.

U. P. BASU, S. MUKHERJEE and S. BHATTACHARYA
(Baranagar, Calcutta)

The economics of the manufacture of potassium chlorate in India is discussed. Potassium chlorate can be produced by a modified process at one rupee per pound in India while the imported chemical costs three rupees per pound.

177. Furfural Plastics.

S. RANGA IYENGAR (Bhadravathi)

Results obtained at Bhadravahi with a pilot plant for the manufacture of furfural and furfural plastics from agricultural waste materials rich in pentosans are discussed. Optimum conditions for the manufacture of furfural were determined.

Experiments were directed to obtain thermosetting moulding compositions similar to Bakelite (70) in an existing Pilot Plant manufacturing Phenol-Formaldehyde synthetic resins and moulding powders on a production basis. Equimolecular proportions of furfural and phenol were condensed in presence of different catalysts to obtain the desired resin. Only basic catalysts were found suitable and a 3.5% sodium hydroxide as 20% solution was found most suitable from the standpoint of increased output and reduction of time of reaction. The yield of resin is nearly two times and that of moulding powder more than four times the furfural used. Moulding compositions

prepared are thermosetting, and have good flow. The articles take a fine polish.

Furfural-phenol and furfural-cresol plastics resemble Bakelite but are either black or dark brown in colour even without the addition of dyestuffs and take a relatively longer time for curing. The curing time has been reduced to 3.5 minutes at 145–50° C. Tests conducted on moulded articles are described. Further tests to standardise Furfural powders are under way. Experiments are being conducted to find out other uses for this versatile aldehyde.

178. The Iodine Content of Indian Sea-weeds.

ITTYERAH JOSEPH (Trivandrum)

Estimation of iodine was made on various samples of Indian sea-weeds collected at different parts of the year and from different places in India. It appears from the collected data that the iodine content of weeds is higher during the colder months (January to March) than during the hotter months (July–August).

179. Antioxidants for Shark Liver Oil—Part X. Influence of certain Hormones, Phenolic Compounds, Synthetic Dyestuffs and Essential Oils on the stability of Shark Liver Oil.

P. K. MATHEW, P. V. NAIR and T. A. RAMAKRISHNAN
(Trivandrum)

Substrates of saw fish liver oil and tiger shark oil have been employed for determining their response towards common antioxidants. The hormones which had practically no effect in saw fish oil in mild concentration have been found to evoke a greater response from tiger shark oil.

Among the essential oils tried for their antioxidant properties—cinnamon leaf oil, cardamom oil, oil of pepper, oil of ginger, oil of *Ocimum gratissimum*, lemon grass oil, oil of nutmeg, cloves and peppermint—none of them seems to have any effect on the stability of either tiger shark or saw fish oil.

Naphthol dyes are indifferent in their activities while alizarin had pronounced pro-oxidant influence on substrates of both the oils.

Quinhydrone and *o*-naphthol were found to have relatively high antioxidant properties whereas *o*-cresol and phenoquinone were only feebly antioxidant.

180. Antioxidants for Shark Liver Oil—Part XI. Influence of some Organic and Inorganic Acids and some Organic Substances on the stability of Shark Liver Oil.

P. K. MATHEW, P. V. NAIR and T. A. RAMAKRISHNAN
(Trivandrum)

A substrate of tiger shark liver oil remained practically unaffected by the addition of 0.1% of its weight of 20% sulphuric acid while on the same substrate orthophosphoric acid was observed to have a mild antioxidant activity and hydrochloric acid, if anything, a prooxidant tendency.

Malic acid and hippuric acid which were tried as probable antioxidants furnished indifferent results on pristis oil and on other trade samples of shark liver oil while β -indolyl acetic acid (hetero-auxin) showed definite pro-oxidant tendency.

Among the miscellaneous organic substances tried—Purpurogallein Phenolphthalein, Gammexane and Sodium taurocholate—purpurogallein alone had pronounced antioxidant activity which is presumably due to the pyrogallein group present in its molecule.

181. Alginic Acid from Sargassam Sea-weeds of the Travancore Coast.

K. SADASIVAN PILLAI and N. S. VARIER (Trivandrum)

Sargassam sea weeds are obtainable in considerable quantities from the rocky coast-line extending from Cepe Comerin to Kovalum. The optimum conditions for obtaining alginic acid have been worked out. The use of sodium and ammonium alginates in the creaming of rubber latex has also been investigated.

182. Building Lime Industry in Travancore.

R. KRISHNA PILLAI (Trivandrum)

Lime shells collected from the backwaters and coastal tracts in Travancore are extensively used in the production of building-lime. In spite of the crude methods employed, the industry is believed to give profitable returns. The country kiln which involves very considerable heat losses, the insufficient adjustment in the proportion of shell and fuel and the poor quality of the shells themselves often account for the low CaO content of the burnt lime.

Several samples of lime shells collected from different parts of the State have been analysed and their CaO contents found to vary from 49–54%. The CaO content of the burnt lime obtained from different kilns was however found to be 24–40%.

183. Minor Forest Products of Travancore—Part I. Furfural from Wood Wastes.

C. S. BHASKARAN NAIR, P. V. NAIR and M. SREEDHARAN PILLAI (Trivandrum)

The wood wastes from twelve varieties of timber and fuel wood trees indigenous to Travancore have been subjected to examination with a view to utilizing them in the manufacture of furfural. Distillation with 12% HCl without pretreatment afforded results varying from 7·15% furfural with *Terminalia paniculata* Roth to 13·15% with *Tamarindus indica*. Experiments in improving the yield with hypobromite and other suitable pretreatment are in progress.

184. Minor Forest Products of Travancore—Part II. Composition and Processing of Forest Honey.

P. V. NAIR, M. SREEDHARAN PILLAI and K. S. MADHAVAN PILLAI (Trivandrum)

Representative samples of forest honey collected by the Travancore Forest Department have been analysed and compared with apiary honeys and the so-called medicinal honeys. The observed variations in the chemical composition between forest and apiary honeys are inconsiderable. The differences attributed to their nutritional efficiency are presumably due to subtle variations in their invertase and diastase activity and to the presence of microquantities of characteristic colloids.

A convenient method for the processing of forest honey in Travancore has been recommended.

185. Minor Forest Products of Travancore—Part III. *Spatholobus roxburghii* and *Myristica attenuata* resins.

K. N. GOPINATHAN NAIR, P. V. NAIR and (Miss) P. SARADAMMA
(Trivandrum)

The transparent, ruby coloured gum which exudes from the barks of *Spatholobus roxburghii* (N.O. Leguminosæ) furnished a tannin which on fusion with potash yielded catechol. Its methyl and acetyl derivatives have been prepared. *Myristica attenuata* (N.O. Chloranthaceæ) resin contains a catechol tannin whose methyl and acetyl derivatives have been prepared. Tinctorial experiments with these dyes are in progress.

186. Minor Forest Products of Travancore—Part IV. *Parkia biglandulosa* bark.

(Miss) T. PANKAJAKSHY AMMA, P. V. NAIR and T. V. PUNNOOSE
(Trivandrum)

Parkia biglandulosa (N.O. Leguminosæ) barks have been used for tanning and dyeing purposes. The purified tannin gave catechol on fusion with potash and the characteristic reactions of phlobatannins. The methyl and acetyl derivatives have been prepared. Tinctorial experiments with the dye on mordanted cotton hanks are in progress.

187. Minor Forest Products of Travancore—Part V. *Sterculia urens* resin.

P. V. NAIR, M. SREEDHARAN PILLAI and K. S. MADHAVAN PILLAI
(Trivandrum)

Sterculia urens Roxb. (N.O. Sterculiaceæ) grows wild in the Travancore forests and its stem exudes a rather plentiful resin. The tannin matter isolated from the resin gave catechol and protocatechuic acid on fusion with potash and for the most part consists of a phlobatannin as proved by its reactions. Its methyl and acetyl derivatives, both of which have been prepared, have showed the existence of three OH-groups.

Tinctorial experiments with the extracts of the dye on mordanted cotton hanks afforded a variety of pleasing shades, all of which were shown to be fairly fast to light and soapwash.

188. Studies in the Technology of Shark Liver Oil—Part VI.
The Bellier Figure as an Index of adulteration of Shark
Liver Oil with Groundnut Oil (Contd.).

P. K. MATHEW, P. V. NAIR and T. A. RAMAKRISHNAN
(Trivandrum)

In Part II of this series (*Abs. Proc. I.S.C.*, 1947), the authors had indicated a line of approach to a "rough and ready" method for the determination of the percentage of adulteration in market samples of shark liver oil with groundnut oil. Over thirty samples of fresh and rancid shark liver oil drawn from different species of fish were examined and it was generally observed that fresh oil returned values varying between 23 and 24 while rancid oil gave slightly higher results but never exceeding 25.2.

The iodine value of the oil does not bear any relation to the Bellier Figure, which appears to be constant within a narrow range as long as the oil is homogeneous. Partial destearination of the oil effects hardly any lowering in the Bellier Figure. The relation between the Bellier Figure and the percentage of groundnut oil added can be represented in the form of a smooth curve.

189. Studies in the Technology of Shark Liver Oil—Part VII.
Optimum pH for the Enzymolysis of Shark Liver Oil
with Castor Seed and Pancreatic Lipases.

P. V. NAIR, T. A. RAMAKRISHNAN and H. SREEMULANATHAN
(Trivandrum)

Qualitative observations on the comparative efficiency of ricinus and pancreatic lipases in the enzymic hydrolysis of shark liver oil were made in a previous communication (*Abs. Proc. I.S.C.*, 1947). Lypolysis was effected on the same sample of shark liver oil both with castor seed powder in acetate buffers (pH 3·9–5·4) and with pancreatic extract activated with sodium taurocholate (M—10,000) in borate buffers (pH 8–10). Under the conditions studied, the optimum pH for the lypolytic action of castor seed lipase has been found to be 4·2 (*ca*) and that of pancreatic lipase to be 8·8.

190. Studies in the Technology of Shark Liver Oil—Part VIII.
A Comparative Study of the Progress of Enzymolysis in
Shark Liver Oil and other Edible Fats with Pancreatic
Lipase.

P. V. NAIR, T. A. RAMAKRISHNAN and H. SREEMULANATHAN
(Trivandrum)

The degree of lypolysis of shark liver oil with pancreatic extract has been compared with those of coconut oil, sesame oil, ghee and vanaspati under identical conditions of experiment. The digestibility of these fats as revealed by the progress of lypolysis under standardized laboratory conditions has been found to be in the order given:—coconut oil, sesame oil, vanaspati, ghee, shark liver oil.

191. Studies in the Technology of Shark Liver Oil—Part IX.
Progress of Enzymolysis in Shark Liver Oil and other
Edible Fats with Castor Seed Lipase.

P. V. NAIR, T. A. RAMAKRISHNAN and H. SREEMULANATHAN
(Trivandrum)

The degree of hydrolysis in shark liver oil and other edible fats such as coconut oil, cow's ghee, buffalo ghee, sesame oil, vanaspati and beef tallow with a uniform preparation of castor seed lipase was followed by the titrimetric method. It was observed that there was appreciable parity between the initial rates of breakdown in all the substrates. The digestibility as revealed by the degree of hydrolysis decreases progressively from coconut oil to beef tallow in the order stated:—Coconut oil, cow's ghee, buffalo ghee, sesame oil, vanaspati, shark liver oil, beef tallow.

192. Studies in the Technology of Shark Liver Oil—Part X.
Degree of Enzymolysis in Shark Liver Oil of Varying
Origin and in Adulterated Shark Liver Oil.

P. V. NAIR, T. A. RAMAKRISHNAN and H. SREEMULANATHAN
(Trivandrum)

The action of castor seed lipase on substrates of shark liver oil collected during different seasons and from different species of sharks was followed by the usual method under standardized conditions of experiment. It was expected that the result would, furnish an insight into the comparative digestibility and consequently of the therapeutic and nutritional efficiency of the

oils; and, provide a suitable basis for the blending of these oils in manufacturing practice.

Although the seven samples of oil subjected to lypolysis had divergent physical and chemical characteristics, their response to lipase was found to be nearly the same. The "Hydrolytic Index" could be successfully applied to the detection of adulteration in trade samples of shark liver oil which are usually blended with varying proportions of groundnut oil. Laboratory tests with known mixtures of shark liver oil and groundnut oil have confirmed this conclusion.

193. Studies in the Technology of Shark Liver Oil—Part XI.
Halogenation of Deoxygenated low grade fish oils.

(Miss) K. PANKAJAKSHY AMMA, P. V. NAIR and
T. A. RAMAKRISHNAN (Trivandrum)

Low grade shark liver oils which are poor in vitamin content find use at present, only for caulking boats. On deoxygenation with zinc dust, the oils could be made to yield a product containing nearly 98% hydrocarbons. The reduced product was chlorinated under varying conditions. On subsequent fractionation at a temperature range of 100–170° C. (45 mm.) and estimation of the chlorine content of each fraction it was observed that the fraction collected between 128–145° C. contained as much as 23% chlorine. Alcoholic potash liberates about 14.2% of the chlorine from this fraction, while aqueous potash releases 2.8% and boiling water 0.96%.

The insecticidal properties of the chlorinated products are being investigated.

194. Travancore Marine Oils—Part IV. Physical and Chemical
Characteristics of Shark Liver Oils.

P. K. MATHEW, P. V. NAIR and T. A. RAMAKRISHNAN
(Trivandrum)

The physical and chemical constants of several samples of liver oils drawn at the Government Shark Liver Oil Factory, Trivandrum, from *Stegostoma tigrinum* and *Pristis cuspidatus* have been determined. Considerable variations in the initial physical and chemical characteristics have been observed with oils expressed from the same species of fish.

195. Nitro-Cellulose in Peace and War.

S. K. K. JATKAR and D. S. SASTRY (Bangalore)

Nitrocellulose has come to stay in explosives, plastics and lacquers. The properties of the lower nitrates containing less than 10% nitrogen and their utilisation is being studied with new types of plasticisers of the vinyl acetate type. Mixed esters of the nitro-acetyl type whose properties will be different from both the nitro- and acetyl-esters will also find increasing applications. With advances in manufacturing processes and discoveries of new usages for this material it will still play an important role in the service of humanity.

196. Performance of the secondary milling unit in Sugar
Factories.

K. S. GURURAJA DOSS (Cawnpore)

Several expressions have been proposed from time to time for comparing the performance of the secondary milling units. The defects in these have

been pointed out. The following new scheme based on the theory of milling formulated by the present author has been shown to be the best for the purpose:—

- (i) Calculate the secondary juice extraction by the formula

$$e_s = \frac{J_s g_s}{g_p (1 - f)}, \text{ where } J_s = J_m \frac{g_p - g_m}{g_p - g_s}$$

- (ii) Calculate R'_v by the formula

$$R'_v = \frac{e_s}{1 - e_p}$$

$$\text{where } e = \frac{m_p - f}{m_p (1 - f)}$$

- (iii) Calculate R_v by the formula

$$R_v = \frac{1}{1 + \left\{ \frac{1}{R'_v} - 1 \right\} \frac{Kmp - 2mp + 1}{Kmp}}$$

- (iv) From R_v and n , the No. of mill in the imbibition train; find out the ideal value of K_i as per theory, by referring to Table I of Noel Deerr's paper (*I.S.J.*, 1930, 473).

- (v) Efficiency of the secondary unit

$$= \frac{K_i}{K} \times 100.$$

Symbols: J = Juice per unit cane.

g = Brix.

f = fibre per unit cane.

m = fibre per unit bagasse.

e = extraction.

K = added water per unit fibre.

Suffixes: s = secondary, p = primary, m = mixed.

197. A Comparative Study of the Properties of Synthetic fibres prepared by Viscose Process from different Cellulosic Materials.

P. S. VARMA and ABHAYA SINHA (Benares)

Synthetic fibres from different cellulosic materials have been prepared and their physical and chemical properties have been examined. Only a slight variation in properties was noticed.

198. Cost of Production of Synthetic Fibres in India.

P. S. VARMA and ABHAYA SINHA (Benares)

Artificial silk has been prepared on the model Hagihara machine in the Industrial Chemistry Laboratories of Benares Hindu University by the viscose process from cellulose obtained from various cellulosic raw materials such as jute, hemp, flax, filter-paper cuttings, bamboo-pulp, waste cotton, and waste materials of cotton mills. The cost of cellulosic raw materials varies from one anna and nine pies to five annas and six pies per lb., and the cost of production of artificial silk on the basis of work carried on in our Laboratories comes up to about one rupee and eleven annas per lb., if the production is started on the minimum economic scale.

199. The Anodic Oxidation and Colouring of Aluminium and Aluminium Alloy Articles.

D. R. DHINGRA, G. N. GUPTA and M. G. GUPTA (Kanpur)

The paper gives in detail the theory and processes of anodic-oxidation and colouring of aluminium and aluminium alloys. It is well known that owing to the great affinity of aluminium for oxygen, an oxide film is readily formed when it comes in contact with an oxidising solution. The greater the thickness of the oxide coating, the greater is the protection from atmospheric conditions and corrosion, etc. There are two processes of oxidation: (1) Chemical and (2) Electric-chemical.

In the chemical process, aluminium is immersed in an oxidising solution, e.g., Potassium dichromate or a mixture of sodium carbonate and sodium chromate for 5 to 20 minutes, whereby an oxide coating is deposited on the surface. The oxide coating in such cases is very thin.

To make the coating thicker and uniform, an electro-chemical process is used wherein the metal undergoes anodic oxidation.

Electrolytes, viz., chromic-acid, sulphuric acid, sulphuric acid in combination with glycerine, oxalic acid, ortho-phosphoric acid, boric acid, sulphamic acid, etc., of different concentrations have been studied for satisfactory anodic films on aluminium and aluminium alloys from aeroplane scrap. The optimum working conditions with regard to temperature, voltage, current density, etc., have been found out. It has been shown that sulphuric acid for aluminium and chromic acid for aluminium alloys are most suitable.

For colouring of oxidised aluminium a number of dyes available in the market were tried and very beautiful shades were obtained on aluminium and aluminium alloys. Inorganic colours were also employed.

Details of equipment necessary for utilising 1 cwt. of aluminium sheet per day are given. It is shown that a net profit of 35% on the investment can be expected in the factory.

200. Possibility of Manufacture of Caustic Soda from naturally occurring Reh Soil.

D. R. DHINGRA and S. N. GHATAK (Kanpur)

Reh soil or Rehu matti is a naturally occurring alkaline soil found in the Indo-Gangetic plain. Reh soil mostly contains the soluble salts of sodium (carbonate, sulphate and chloride) clay and organic matter. Reh soils vary in composition from place to place. Sodium carbonate content varies from 1 to 9% sodium sulphate 1 to 6% and sodium chloride 1 to 3%. The important constituent of Reh soil is sodium carbonate. In the villages where the Reh soil is available it is leached with water and the extract evaporated to dryness. This crude product is technically called Sajji which contains 35 to 55% sodium carbonate, 15 to 30% sodium sulphate and 5 to 10% sodium chloride.

For the preparation of crude caustic soda sajji was roasted to free it from organic colouring matter. It was then extracted with boiling water. The extract was decanted and filtered off from insoluble matter and causticised with the required amount of lime (theoretical quantity plus 20% more). Causticised liquor was concentrated to 70° TW (1.35 sp.gr.) when sodium sulphate crystallised out. The solution was then concentrated to above 50° Be (1.526 sp.gr.) or evaporated to dryness to yield lumps of caustic soda. Incrustation formed, from time to time, was separated by means of perforated laddles and flakes were obtained. The following results were obtained:—

Sajji containing 32% Na_2CO_3 gave a yield of 87.5% caustic soda (solid lumps) and 75% caustic soda (flakes). Solid caustic soda composition was 79.08% NaOH, 7.50% Na_2CO_3 , 3.05% Na_2SO_4 and 1.07% NaCl. Flakes had 92.8% NaOH, 0.8% Na_2SO_4 and 0.3% NaCl.

In these days of acute shortage of caustic soda causticisation of crude sajji is a very paying proposition.

201. Treatment of Effluents of Distilleries and Tanneries.

D. R. DHINGRA and S. N. GHATAK (Kanpur)

The following experiments were conducted for the treatment of the foul smelling effluents from distilleries and tanneries:—

1. *Distillery effluents*.—Cultured yeast was added (10 grams to a gallon) to the effluent. Air was blown in for about 72 hours to enhance the fermentation. Occasionally steam was passed in order to maintain the temperature at 40° C. (Hot air can also serve the purpose). The acidity was determined and the required amount of lime (12 to 15° Be) was added to bring the pH to about 7. Air was blown for 12 hours and the solid matter allowed to settle. The decanted liquor was taken in another container. “Alumina-Ferric” was added to the liquor at the rate of 1 oz. to a gallon and air was again blown in for another 12 hours. Kept overnight the liquid was perfectly free from smell or suspended impurities. The separated solid may be used as a manure. The liquid, after treatment with bleaching powder (0.25 oz. to a gallon), can be used for irrigating the fields or can be allowed to run into the river without producing any harmful results.

2. *Tannery effluents*.—This type of obnoxious effluent contains suspended matter: hide pieces, skin and hair. Air was blown in for 12 hours and the liquid allowed to settle. Decanted liquid was treated with Alumina-Ferric (4 oz. per gallon) and air was blown in for another 12 hours. The liquid was then passed through a bed of kankar, coal cinder and sand, arranged in 3 layers. The liquid after passing through the filtering bed was treated with bleaching powder (0.25 oz. per gallon). The treated effluent was free from smell or suspended impurities. The solid residue had 2.6 to 3% nitrogen and could be used as a manure. The treated effluent could be used for irrigation of fields.

SECTION OF MATHEMATICS

PRESIDENT : R. VAIDYANATHASWAMY, Ph.D., D.Sc.

1. On a recurrent.

S. CHAKRABARTI, Jadavpur.

If

$$D_3 = \begin{vmatrix} {}^6S_1 & {}^6S_2 & {}^6S_1 & {}^1S_2 & a^2 + (-)^3 {}^6S_1 \\ 1 & {}^3S_1 & {}^3S_1 & {}^3S_2 & a^2 \\ & 1 & {}^4S_1 & {}^2S_2 & a^2 \end{vmatrix}$$

then $D_k = (-)^p k \cdot {}^3S_1 \left[\begin{smallmatrix} k+2 \\ 3 \end{smallmatrix} \right]_2$ or $(-)^p k \cdot {}^3S_1 \left[\begin{smallmatrix} k+1 \\ 1 \end{smallmatrix} \right]_2 a_{k+1}$ according as k is odd or even,

p being the integral part of $\frac{k-1}{2}$ and $a_{k+1} = 1 + a^3 + a^5 + \dots + a^{k+1}$.

2. Bending of clamped rectilinear plates.

B. R. SETH, Delhi.

In a recent paper we have discussed the bending of rectilinear plates with supported edges and have shown how the solution can be made to depend on the corresponding solution for the boundary when the plate is bent by uniform pressure. When the edges are clamped, the problem does not yield an easy solution. The known case of a rectilinear plate has been widely discussed, and its solution has been obtained in the form of a double Fourier's series. In this paper it is shown that the general case of a rectilinear plate can also be obtained in the form of a double Fourier's series. The case of a regular polygonal plate is discussed in detail.

3. A type of solutions of Einstein's gravitational equations.

J. GHOSH, Chinsura (Hoogly)

Assuming the gravitational equations in the form

$$k_{pq} - \frac{1}{2} g_{pq} k + \beta g_{pq} = -8\pi T_{pq}$$

the author has derived a complete solution of the problem of a homogeneous material sphere in which the radial and transverse stresses are linearly related.

4. On linear difference equations.

S. M. SHAH, Aligarh.

In a recent paper (Bulletin American Math. Soc. Vol. 53 No. 6, June 1947 pp. 548-558) I proved that if $y(x)$ be a real continuous solution of an algebraic difference equation of the first order,

$$P(y(x+1), y(x), x) = 0 \quad \dots (1)$$

then

$$\lim_{x \rightarrow \infty} \inf \log \log |y(x)| < \infty$$

I also showed that this result is the best possible. If however we consider linear difference equation with polynomial coefficients

$$P_m(x)y(x+m) + \dots + P_n(x)y(x) = Q(x) \quad \dots (2)$$

then we can obtain a better upper bound for $y(x)$.

Theorem

If $y(x)$ be a real continuous monotonic solution of linear difference equation (2), then

$$\lim_{x \rightarrow \infty} \sup \frac{\log |y(x)|}{x \log x} < \infty$$

Two more theorems on linear difference equations are also established.

5. Note on a new method of solving problems of thin elastic plates.

B. SEN, Sibpur.

Recently a new method of finding stresses in large thin plates has been discussed in a paper accepted for publication elsewhere (Sen, 1946). In this note the method has been extended to problems of thin plates having cavities of different shapes, the plates being supposed to have a distribution of all round tension at great distances from the cavities. The cavities considered are those having boundaries in the form of (1) an inverse of an ellipse, (2) a loop of a lemniscate, and (3) an approximate square with rounded corners.

6. Vibrations of an infinite linear lattice consisting of two types of particles.

N. S. NAGENDRA NATH and SANAT KUMAR ROY, Patna.

The problem of the vibrations of a linear lattice has attracted considerable attention from the time of Lagrange who investigated the vibrations of a finite lattice with fixed end particles (*Mecanique Analytique* Vol. 1.). Hamilton investigated the problem of the vibrations of an infinite linear lattice consisting of identical particles under certain initial conditions (*Hamilton's Mathematical Papers* Vol. 2.). This paper deals with the vibrations of an infinite linear lattice consisting of two types of particles. The solutions for the displacements can be represented as complex integrals taken along suitable contours on a Riemann Surface of four sheets. These solutions are

$$x_{2r} = \frac{1}{2\pi i} \int \frac{f_1 \cos \omega_1 t + f_2 \cos \omega_2 t}{z^{\Gamma+1}} dz$$

$$x_{2r+1} = \frac{1}{2\pi i} \int \frac{g_1 \cos \omega_1 t + g_2 \cos \omega_2 t}{z^{\Gamma+1}} dz$$

where $f_1, f_2, g_1, g_2, \omega_1$ and ω_2 are certain functions of the complex variable z . When the masses are equal the solutions reduce to Bessel's functions of even order (Hamilton's Solution). The asymptotic nature of the above integrals has been investigated by the method of steepest descents. This shows that any general solution is to be obtained as a Fourier wave packet and that it tends to a superposition of limiting vibrations as t tends to infinity.

7. On cases of extremum of an interpolation polynomial in two variables.

ANUNOY CHATTERJEE, Patna.

When a set of three observations are taken near a maximum or a minimum, the approximate value of the independent variable for which the interpolation polynomial is maximum or minimum has been obtained (Milne-Thomson, *Finite Differences*, 1933, 19). In the present paper the author has investigated the cases of extremum of the interpolation polynomial for four observational values at the corner points of a small rectangle in near vicinity in the XY-plane and has attempted to deduce sets of sufficient conditions that such an extremum may be a real maximum or a real minimum with regard to the four observational values.

8. The asymptotic number of latin rectangles.

S. M. KERAVALA, Calcutta.

Recently, Erdős and Kaplansky have succeeded in proving that the number $f(n, k)$ of n by k Latin rectangles is given asymptotically by :

$$(n!)^k \exp(-kC_1) \left[1 - \frac{k(k-1)(k-2)}{6n} + \frac{k(k-1)(k-2)(k^3-3k^2+8k-30)}{72n^2} - C \right]$$

where $C=O(n^{-3})$. In this paper, I show that

$$C = \frac{k(k-1)(k-2)(5k^6-30k^5+155k^4-780k^3+1874k^2-4788k+9288)}{6480 n^3} + O(n^{-4})$$

9. A note on the equilibrium of a fluid-mass under a steady differential rotation.

N. L. GHOSH, Calcutta.

The purpose of the present paper is to point out certain restrictions on the density-distribution of a fluid-mass rotating steadily about an axis of symmetry with a variable angular velocity, in the case where the gravitational potential is a function of the density only. Such a case has been considered by P. Dive in Rotations Internes Des Astres Fluides, though no solutions have been obtained and the restrictions imposed on the density by the assumption have not been noticed either.

The note also contains two illustrations of the general problem mentioned under the assumption that the potential is due entirely to a very heavy central attracting sphere. It has been found that it is possible for the surrounding fluid to be in equilibrium either in the form of a spheroid, very much like a thin atmosphere or in the form of an anchor ring with the attracting mass at the centre. No pressure density relation has been assumed. The question of stability, however, has not been investigated.

10. An inversion formula for the generalised Laplace transform.

R. S. VARMA, Lucknow.

In a paper to be published in the Proceedings of the Edinburgh Mathematical Society, I gave an inversion formula for the generalised Laplace Transform, given by me at the Indian Science Congress, Nagpur (1945). In this paper, I have investigated another inversion formula for this transform.

11. On a fluid motion possessing axial symmetry.

RAM BALLABH, Lucknow.

A study has been made of rotational motions (velocity q) in a homogeneous incompressible viscous fluid, for which

$$r \cdot \nabla \times q = 0$$

and which can be superimposed upon the irrotational motion given by

$$\varphi = Ux,$$

U being a constant.

It has been shown that

$$u = u_0 + \frac{1}{2} \int f(Y) dY$$

$$v = v_0,$$

$$w = w_0,$$

u_0, v_0, w_0 being harmonic functions, and $Y = y^2 + z^2$

Particular solutions making the fluid velocity vanish at infinity have also been obtained.

12. A generalisation of the Hankel-Transform.

R. P. AGARWAL, Lucknow.

In this paper I have generalised the Hankel integral equation

$$g(x) = \int_0^{\infty} (xy)^{\frac{1}{2}} J_{\lambda}(xy) f(y) dy$$

by considering the kernel $(\frac{1}{2})^{\lambda} x^{\lambda+1} J_{\lambda}^{\mu}(x^2/4)$ where

$J_{\lambda}^{\mu}(x)$ is the Maitland's Generalised Bessel function. I have also deduced a number of properties of functions connected by the integral equation

$$g(x) = (\frac{1}{2})^{\lambda} \int_0^{\infty} (xy)^{\lambda+1} J_{\lambda}^{\mu}\left(\frac{x^2 y^2}{4}\right) f(y) dy$$

This equation for $\mu = -1$ reduces to the ordinary Hankel's Equation.

13. On the non-summability (A) of the conjugate series of a Fourier series.

U. N. SINGH, Allahabad.

In this paper we prove the following theorem.

Theorem. At a point x , where

$$\int_0^t \psi(u) du = O(t), \quad \psi(u) = f(x+u) - f(x-u),$$

the divergence of the integral $\bar{f}_{\eta}(x) = \frac{1}{2\pi} \int_{\eta}^{\pi} \psi(t) \frac{1}{2} \cot \frac{1}{2} t dt$ as $\eta \rightarrow 0$, to $\pm \infty$ is

a necessary and sufficient condition for the divergence to $\pm \infty$ of the conjugate series of the Fourier series of $f(x)$.

14. On the Nörlund summability of Fourier series.

J. A. SIDDIQI, Allahabad.

A sequence (s_p) is said to be summable by a regular generalized Nörlund method of summation (N, p_p) if

$$\lim P_n^{-1} (p_n s_0 + p_{n-1} s_1 + \dots + p_0 s_n)$$

exists, where $P_n = p_1 + p_2 + \dots + p_n \neq 0$, (p_r) , being a sequence of complex numbers subject to the regularity conditions

$$\sum_{k=0}^n |p_k| < b |P_n| \quad \lim_{n \rightarrow \infty} \frac{p_n}{P_n} = 0$$

We have established the following theorem :

Theorem : A regular Nörlund method of summation (N, p_r) sums the Fourier series of a function $f(x)$ which is integrable in the sense of Lebesgue and is periodic with period 2π , to the sum $f(x)$ at the points at which

$$\int_0^t g(u) du = O(t), \quad \int_0^t |g(u)| du = O(t)$$

provided the generating sequence (p_r) satisfies the following condition

$$\sum_{k=0}^n |\Delta p_k| + |p_n| < b |P_n| \cdot n^{-1}$$

SECTION OF ANTHROPOLOGY AND ARCHAEOLOGY

PRESIDENT : A. CHATTERJEE, M.B., B.S.

1. Study of the head-hair of the Parois, a fishing Caste of Hogladanga in the district of Jessore, Bengal.

M. N. BASU, Calcutta.

Sixty hair samples are studied with respect to—

- (1) Colour—Matching with the graded tones of the Fischer-Saller Haarfarbentafel.
- (2) Form—Microscopic examination after Trotter, to find out the index.
- (3) Size—Area of cross-section.

2. Book insects and Preservation.

M. N. BASU, Calcutta.

Different kinds of book insects, their habitat and the methods of preservation are discussed.

3. Study of the voluntary movements recorded by Dynamometer as modified by pleasant and unpleasant stimuli among the Noluas of Bengal.

M. N. BASU, Calcutta.

Experiments on 200 adult male Noluas, age varying from 22-30 years, are done. Effects of pleasant and unpleasant stimuli are also discussed.

4. A note on a dipnet- the Vesal.

M. N. BASU, Calcutta.

The specimen is collected from a fisherman's village (Hogladanga) in the district of Jessore, Bengal. An ethnographical account is stated.

5. A preliminary note on comparability of measurements.

K. P. CHATTOPADHYAY, Calcutta.

In determining racial affinity, it is often necessary to compare measurement of living subjects, taken by different observers. As the landmarks on a living subject are not so exactly defined as on crania or the limb bones, it is important to ascertain how far measurements on the living are comparable, when made by different observers. In the series of observations described head length, head breadth and head height on the same set of 50 subjects by three observers. The results are analysed.

6. The Korku village and house type in Melghat.

K. P. CHATTOPADHYAY, Calcutta.

In this note the writer describes the plan of Korku villages in Melghat forest, and the details of construction of the huts.

7. A Santal scissors trap.

K. P. CHATTOPADHYAY, Calcutta

The writer describes a somewhat uncommon type of trap collected by him among Santals. It has been found by Hutton among Nagas of Assam.

8. Santal economy in Bengal.

K. P. CHATTOPADHYAY, Calcutta.

The writer describes the present structure of landownership among Santals in Bengal and compares it to their traditional concept of rights in land.

9. Megalithic Monuments of the Chingleput District.

V. D. KRISHNASWAMI and N. R. BANERJEE, Madras.

This paper incorporates an account of the recent exploration conducted by the Archaeological Survey of India, in the Chingleput District, adjoining Madras, and in the areas peripheral to it.

The previous casual notices of megalithic sites in this region, served along with other geomorphic factors to make a thorough ground survey for these monuments, long wished for by Robert Sewell, since 1882.

Physiographically the region is divisible into two parts, lateritic in the North and granitic in the South. While the control of Geology can always be traced on the monuments, the megaliths, here, resolve themselves into two main types : namely (a) Cairn circle, and (b) Dolmenoid Cist. They have also a number of variations and there are also barrows (urnfields). The mutual relationships between them are discussed in detail.

A study of the associated pottery and other objects collected from these megaliths has been dealt with at some length, with a view to dating these eluding monuments of Chingleput, that relate to a robust civilization, long forgotten, but very near to our own, in social structure. The distribution of these monuments in Chingleput indisputably leads to the conclusion that the megalithic folk have heralded the introduction of the irrigation complex into this part of India.

10. A study of the Surnames of the Daksinatya Vaidika Brahmans of Bengal.

T. C. RAY CHAUDHURI, Calcutta.

The Kulapanjikas give a number of surnames of the Daksinatya Vaidika Brahmans of Bengal. Most of them have become obsolete—of these some may still be traced in local names. Some again such as Dhar Sharma, Kar Sharma, Nandi Sharma and Bhadra Sharma may throw some light on their social relations. These surnames without the appendix sharma are found among the Vaisyas, Kayasthas (Sudras) and Vaidikas. Manu's injunctions regarding surnames. At present the surnames, Dhar, Kar, Nandi, Bhadra, Sen, Shur, Deva, Bhrahma, Chandra, Shome, Dutta, Aditya, Mitra etc—are met with in the Kayastha (sudra) society. Now that being so are we to correlate the D. Vaidikas with the Vaisyas or Kayasthas? Of these Kayasthas cannot claim to have a separate existence as a caste group—they are not heard of before the 9th Century.

11. Traditions regarding the early history and migration of the Vaidika Brahmans.

T. C. RAY CHAUDHURI, Calcutta.

Kulakarikas are at variance—Tradition regarding origin—regarding Jasodhara—Syamal Varma—Relative priority of the two Sections—Pascatya and Daksinatya—The filiation of the Vaidika Brahmanas cannot be supported by anthropometric data.

12. Blood Groups of the Oraons working in the Tea Estates of Duars in Jalpaiguri District.

R. N. BASU, Calcutta.

13. Bengali Mandible—its Osteometric measurements.

R. N. BASU, Calcutta.

50 mandibles were measured and their data analysed.

14. Investigation of the foramen Crotophitico Buccinatorius in the Human Skull.

M. M. COOPER, Medical College, Madras.

The aim of this paper is to investigate the occurrence of the foramen Crotophitico Buccinatorius in the human skull. This foramen is a constant feature in the monkey.

The earliest reference to it was made by Hyrtl in 1862. Bryce in Quain's Anatomy describes the foramen in about 1.4% of human skulls.

It is stated that this foramen is precisely between the lateral pterygoid lamina and the under surface of the great wing of the sphenoid, transmitting when present "the lesser division of the mandibular nerve".

OBSERVATIONS :

A hundred South Indian skulls in the Department of Anatomy (Madras Medical College) were examined, and in one skull the foramen was found well formed and that only on one side. On the other side it was present but incomplete. The foramen was seen to be formed by a bar of bone extending from the root of the lateral pterygoid lamina to the under surface of the great wing of the sphenoid. Three other skulls, showed the foramen, ill-formed, represented only by two opposing spicules of bone.

DISAPPEARANCE OF THE FORAMEN IN MEN :

The cause of disappearance from the human skull, of this foramen, ordinarily found in the monkey, remains unexplained. An attempt is made here to offer a probable explanation.

In the monkey the lateral pterygoid lamina is (in proportion to skull dimensions) very much broader, than in man, and has consequently greater access to the under surface of the greater wing of the sphenoid, reaching which, it encloses the foramen crotophitico buccinatorius. In man however, the lamina has narrowed down, with the consequent obliteration of the foramen. The reason as to why the lamina has narrowed down is to be found in the fact that man's masticatory powers and function have been much reduced; and the lamina which gives rise to a powerful muscle of mastication has consequently become narrow. This is in keeping with Weidenreich's view.

15. Notes on land tenure and law of inheritance among the aboriginal people of Assam.

TARAKCHANDRA DAS, Calcutta.

Conception about ownership of land among the shifting hill cultivators. Consideration of the claims of different bodies to the land around the village. Recent changes in attitude. Suggestions for enactment.

Inheritance of movable and immovable property among the Assam tribes. Distribution of primogeniture and ultimogeniture in Assam. Recent trends of changes in the law of inheritance.

16. Acculturation in a tribe of Chota Nagpur

BY TARAKCHANDRA DAS, Calcutta.

The Hos of Kolhan have come in contact with the advanced people of Chota Nagpur and its surrounding regions for a long time. The process of acculturation started by this contact has received new impetus through industrialization of the district of Singhbhum and improvement of transport facilities.

Changes introduced in different culture-traits. Consideration of their effect on the life of the Hos.

17. The aboriginal problem in India.

L. A. KRISHNA IYER, Madras.

Tribal administration has been a Central subject under the Government of India Act of 1935. The Government of India classified aboriginal areas into Excluded and Partially Excluded Areas which kept them beyond the purview and jurisdiction of the Provincial Governments. With the grant of freedom to the Indian Union, Provincial Governments will have to assume responsibility for the care and welfare of the aboriginals in their areas. Already the Mardas, Bombay and United Provinces Governments

have constituted Aboriginal Committees to report on measures for their uplift. Anthropologists should be associated with tribal work to preserve tribal culture. The Government of H. E. The Nizam of Hyderabad have established a Social Service Cadre under Baron von Furer Haimendorf to administer the aboriginals. Orissa also has created a Social Welfare Department. It is hoped other Provincial Governments will follow in their wake and enlist the services of anthropologists for their work.

18. Blood group frequencies in the various castes and tribes of cultural Gujarati.

D. N. MAJUMDAR and K. KISHEN, Lucknow.

About four thousand people of Gujarati including Kathiwar and Kutch were examined in connection with the Racial and Serological Survey of Cultural Gujarati on a random sample basis, in 1946. The Survey was undertaken at the invitation of the Gujarati Research Society, Bombay, and financed by the Society.

In this paper, the results of the statistical analysis of the blood-group data of 22 castes and tribes of cultural Gujarati are presented. The analysis reveals heterogeneity among the estimated probabilities of A, B, and O genes for the 22 castes and tribes which is ascribable to the differences among the estimated probabilities p of A genes, q of B genes and r of O genes. Whilst the results are in conformity with those derived from the analysis of the anthropometric data they are in contrast with those obtained from the analysis of blood groups data of representative castes and tribes of the United Provinces where the heterogeneity among the estimated gene probabilities was attributable only to the differences in p , the differences in q and r being not significant. (The Eastern Anthropologist, Vol. I, No. I, pp. 8-16)

19. Industrial relationship in some industries of Bengal.

J. K. BOSE, Calcutta.

Very few attempts have been made to study industrial relationship from the scientific point of view. In this paper an attempt has been made to show the relationship between the worker and management in some industries around Calcutta. Some of the typical cases have been discussed to illustrate the present position and a suggestion has been made for its improvement.

20. On the Finger and palmar prints of the Santals.

P. C. BISWAS, Delhi.

The present paper is on the finger and palmar print of the Santals of the Maldah District of Bengal. In the Santal hand the white formula 11.9.7.(1-5) appears in larger number than the Negro formula, 7.5.5.(1-5). The pattern loop appears on the hypothenar area of the Santal hand, in 28%, and on thenar area only, in 6% and on the III and IV interdigital areas it appears in 18% and 34% respectively. Among the combination formulae of the three interdigital areas of the hand of the Santals, 0.S.0., 0.0.S., and 0.0.0. appear in higher frequency.

The pattern loop, in the fingers of the Santal, appears in larger number than the whorl and in the occurrence of patterns loop and whorl in the finger of the Santal, a great similarity can be seen with the Negroes.

21. An Epigraphical record of a social ostracism

R. BASUDEVA PODUVAL, Trivandrum.

22. A note on Rh. incidence.

S. D. S. GREVAL, Calcutta.

SECTION OF MEDICAL & VETERINARY SCIENCES.

PRESIDENT: DR. G. D. BHALERAO, Ph.D. (Fac. Med. London),
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MEDICINE AND PUBLIC HEALTH

1. A study of Lichen Planus in India.

G. PANJA, Calcutta.

The ætiology of the disease was investigated. No micro-organisms were found in the lesions by aerobic and anaerobic cultures. The virus theory was also investigated. No solid immunity, no agglutinin against the filtrate of suspension from materials in the lesions, no inclusion bodies in the lesions and no marked improvement with the so-called virus vaccines prepared from the lesions were noticed. The disease was found non-contagious. It showed a plexus or spinal outflow distribution, the lower outflow being more often and more markedly affected than the upper one. The histological picture suggests that the disease primarily occurs in the dermis. The affection occurs more commonly amongst better classes of people. Clinical features of the disease were studied.

Sodium thiosulphate one gm. intravenously twice or thrice a week should be given in acute cases. Autogenous vaccine from stool cultures and arsenic in the form of soamin or enesol are found good in subacute and chronic cases. X'ray exposures to the lesions are found invaluable. An effective external treatment is suggested.

2. Staphylococcal Summer Gastroenteritis at Lucknow.

A. MUKHERJI, Lucknow.

Towards the end of March Gastroenteritis occurs every year at Lucknow and continues for about six months. There is vomiting and purging, but the vomit is neither watery nor is the stool like rice water. The pulse rate bears a proportion to the temperature. Stools are as a rule negative for *Vibrio cholerae*. A preliminary investigation in 1945 pointed towards the possibility of staphylococci being the causative organisms.

This year (1946) 134 stools of gastroenteritis and suspected gastroenteritis were examined bacteriologically. Nine stools revealed *Shigella*, fifteen vibrios and eighty-one showed only staphylococci: twelve of which were strictly anaerobic, 20 had no pathogenic organisms. Various tests were carried out with 69 strains of aerobic staphylococci, 44 of which were of aureus type, 18 albus type, and another 4 of citreus type.

Out of the 69 aerobic strains of the staphylococci coagulase test for virulence were carried with 31 strains and all were found to be positive. Enterotoxin tests were carried out with toxins prepared from eleven of the strains grown in Hinton's Hormone broth for five days at 37°, when four to five c.c. of these toxins were injected intraperitoneally to healthy adult cats. They had tremors, rise of temperature to about 40° C, vomiting and purging. This proves that the strains of staphylococci isolated from the stools of gastroenteritis patients cause the disease.

3. Melioidosis in a Sepoy.

P. R. KRISHNA IYER, Izatnagar.

Blood and urinal samples from Sepoy Aji Ram, age 25 years, an inpatient in 135 I. B. G. H. Bareilly were received for examination. The patient was suffering from pyrexia of an undulant type for about 6 months and he was suspected for *Brucella melitensis* infection. Biological and cultural tests, however, revealed Melioidosis, *Pfeifferella whitmori* being isolated in pure culture from the lesions in the testicles, lungs, liver and spleen of the inoculated guinea-pig. The patient had a history of field service in Burma and far eastern colonies.

4. Biometric Studies of School Children of Hyderabad State.

M. B. DAVER, Hyderabad-Deccan.

It is the first biometric study of school children of Hyderabad State. An investigation of the state of nutrition of over 18,000 school children has been done. Average height and weight for the age group 6 to 15 (boys) was determined. The averages are compared graphically with those of Punjab, Bengal, Madras, Ceylon and American and British boys. Indian children of a given height weigh much less than British or American children. School boys from Punjab and Bengal are heavier and taller than those from Hyderabad State; but Hyderabad boys are superior both in height and weight to Madras and Ceylon school boys. The general result of our investigation is to show that a large percentage of school children in groups examined are suffering from malnutrition due to deficiency diet, both in quality and quantity.

5. Food and its Adulterants.

S. K. CHATTERJI, Calcutta.

Much stress has been laid on the adequate supply of wholesome food to the mass. This country, being a land of plenty can supply that. Proper cultivation, strict supervision and adequate distribution are the three essential factors which come in forefront in the problem. A wholesome food should supply proteins, fats and carbohydrate with vitamins in such a proportion that 3000 calories must be had for an individual as his daily requirements. Lack of these factors in the foodstuff would invariably produce various deficiency diseases and thus would cripple up the whole nation.

Milk being the essential food for growing children, invalids and old are seldom obtained in a pure form. Addition of water to whole milk or to separated milk, adulteration of cow's milk and buffaloe milk with each other, a mixture of fresh milk with stale milk or a mixture of milk powder to diluted milk are the usual procedure for adulterating the milk in this country.

Mustard oil has been known to be adulterated with Pakra oil, argemone oil, arachi oil or even with mineral oils. Recently six samples of mustard oil were forwarded to this department to determine if they were fit for human consumption. They were all found to be heavily adulterated with mineral oil. Coconut oil has also been known to be adulterated with cheap groundnut oil.

Ghee is seldom available in pure form. It is invariably adulterated with hydrogenated oil or cheap animal fat. A case of adulteration of ghee with petroleum jelly is also known to have occurred.

Milk, oil or ghee can however be tested for purity according to the standards laid in the Food Adulteration Act.

Rice and wheat the two staple diets of the nation are also sold in an adulterated state in the market. On being stored for a long time in a damp unhealthy place the quality of rice and wheat deteriorates, loses their Vitamin B, and mineral contents and become unfit for human consumption. Estimation of the Vitamin B, and mineral contents are essentially necessary in these foodstuff in addition to the physical characters to determine their suitability for human consumption. A sample of atap rice should contain Vitamin B, 1 mg./mg and ash .5%. (minimum value) and a sample of unpolished rice should contain vit B, 1.5 Mg./gm. and ash. 7% (minimum).

The wheat and wheat products are heavily adulterated with all possible adulterants. An admixture of bajra, rice or maize starch or of powdered silicates or stone chips with wheat product (atta) had been in practice for sometime. The adulteration with powdered seed of ripe tamarind fruit is a recent development. Soap stone or alum are also possible adulterants. In some cases no wheat starch is present at all in the so called wheat product (atta) sold to public, which consisted entirely of foreign starch or even in some cases no starch at all.

Powdered stone chips, soap stone or alum have no food value rather act as irritants. The foreign starch grains of bajra, rice or maize though not harmful are not desirable. The seeds of ripe tamarind fruit, which contain a small quantity of starch (in addition to certain amount of protein and fat) is said to possess an astringent property and used in cases of dysentery with good results. Thus these tamarind seeds powder can not either be said to be harmful though not desirable.

The Food adulteration Act lays stress on the value of the percentage of ash in these wheat products as the criteria for purity. But the presence of gluten as a qualitative test should also be looked for as routine method to identify the wheat product (atta) and the percentage of gluten should also be determined on which the purity of the staff depends to a certain extent.

6. Calcium Hydroxide (Lime) as a posion.

S. K. CHATTERJI and H. D. GANGULI, Calcutta.

Death from poisoning by a caustic alkali is a rare incident, though of course cases of death from poisoning by caustic soda or caustic potash are on record. But an incident like poisoning by calcium hydroxide (lime) is not on record at all. Such a rare case is therefore no doubt of medicolegal interest.

Portions of human viscera of an undertrial prisoner in a jail was forwarded to us for chemical analysis with a history that the victim committed suicide by taking some lime. He had several vomiting and died in about 2½ hours of taking the lime, the exact amount of lime taken was not known. On post mortem examination the internal organs were found to be only slightly congested. On chemical analysis salts of calcium amounting to 1.34 gram estimated as calcium oxide was detected in the total quantity of the liquid contents (about 200 c. c.) found inside the jar containing the viscera. Calcium oxide (unslaked lime) or calcium hydroxide (slaked lime) are used externally as a caustic in the form of a paste (Vienna paste) to remove warts and other epithelial growths. Calcium hydroxide (lime) is also taken by mouth with betels in pan but that is in a very small quantity, which produces only beneficial effect but no harm.

When taken by mouth these oxides and hydroxides may act as a corrosive poison, the intensity varying with the amount taken. The action of the oxide or hydroxide is due to the alkalinity and not due to calcium. The symptoms of poisoning being as usual severe burning pain in the mouth extending up to the stomach. Vomiting may also take place, the vomited matter having an alkaline reaction. There may be shock and collapse with rapid feeble pulse, cold clammy skin and death may follow within 24 hours as in other strong alkali poison,

These corrosive alkalies are usually used for suicidal purposes rather than homicidal. The treatment followed may be the usual procedure as in other corrosive alkalies.

7. A Case of rapid elimination of Arsenic from tissues in a fatal case of poisoning.

S. K. CHATTERJI and H. D. GANGULI, Calcutta.

Arsenic is a commonly used poison employed for homicidal purpose and the detection of arsenic in the cadaver in a fatal case is of great interest from medicolegal point of view.

Arsenic on being absorbed from the intestinal canal passes to the liver and quite a fair amount is stored there. From liver it passes through blood stream to different parts of body and is then gradually excreted by the kidneys. It has been found that after a single dose of arsenic, it gets eliminated in the urine within half an hour and continues to be excreted for about 10-15 days. In acute arsenical poisoning cases the excretion takes place through urine even for a longer period.

The distribution of arsenic in different parts of body depends much upon the interval between the intake of the fatal dose and the death of the individual. In rapidly fatal cases, the stomach and its contents usually show the presence of relatively larger amounts of arsenic than the other organs, as much time is not elapsed for the poison to be absorbed. In cases where vomiting has been excessive, a large portion of the ingested arsenic is lost by this procedure and very little is left for detection. Though of course there are cases reported in which considerable arsenic has remained in the stomach even inspite of constant vomiting for several days. It is also certain that there will be more arsenic found in the stomach if the poison be taken in solid form than if it is ingested in solution, as the former has a tendency to fix itself to the mucosa and is not ejected out with vomitus.

Arsenic is usually found in tissues submitted for examination in cases where death has not been delayed, yet there are cases on record in English Text Books of Jurisprudence in which no arsenic has been found in any such tissues where death, took place after a period of 7-14 days.

Severi failed to detect arsenic in the stomach and intestines, liver, spleen and kidneys of a person who had died in 8 days after poisoning by Arsenic. In a case of death from arsenical poisoning who suffered the usual symptoms and died on the 16th day, though the stomach was found to be ulcerated, no arsenic was detected on analysis of stomach, liver and spleen.

Elimination aided by copious vomiting caused the removal of all detectable quantities of arsenic in the case of a man who died in 11 days after having been poisoned by arsenic in coffee. No arsenic was detected in the stomach, liver or spleen on analysis.

Recently one such case happened in this country in which the victim was said to have been poisoned by the rival party with the effect that the said victim had severe vomiting for 2 days and then died of exhaustion. On postmortem examination the internal organs did not reveal any definite sign of poisoning and no poison could be detected in the stomach, liver and kidneys of the deceased forwarded for examination in this department. A quantity of earth said to be mixed with the vomited matter of the deceased was forwarded to us later in which an appreciable amount of arsenic was detected. On estimation 3.4 mgs of arsenic (calculated as As_2O_3) was detected in 5 grammes of earth.

A sample of earth from the neighbourhood was wanted for control test and it was found to be arsenic free. So the incessant vomiting for 2 days has eliminated the whole amount of poison administered. This I presume would be of medicolegal interest

in which no arsenic could be detected in the tissues in a case in which death took place only after 2 days of intake of the toxic dose where elimination aided by copious vomiting caused the removal of all detectable quantities of arsenic.

8. "Kirkku Varaghu" Poisoning in man and Animals in Madras Presidency.

G. R. VISWANATHAN, Madras.

Paspalum scrobiculatum, otherwise called in Tamil as Varaghu, is generally used by the middle and labouring class of this presidency as food, instead of rice. This is supposed to be one of the best food containing, plenty of proteins. During recent years, it has been found that this grain and its products produce some intoxicating effects in human beings and animals, when taken as food even after boiling. This is due to the presence of some white fungus like things present in them.

It is called "Kirukku Varaghu" due to the symptoms observed as the result of eating the husk and grain, which are suspected to contain a sort of intoxicating poison. Symptoms seen generally are inappetence, impaction, tympany, vomiting in human being after drinking water, excessive thirst, a sort of giddiness and dullness, unsteady gait and in some cases inability to get up even for 24 hours. Symptoms of madness noticed, in some cases. Death occurs if not attended to immediately. Death is due to asphyxiation.

All animals are affected. Donkeys suffer in an acute manner. More than 10 elephants have died. Post mortem reveals the presence of the grains etc in the stomach. The disease has been produced in dogs and also in a pony by feeding experiments with the suspected material.

TREATMENT:—Plenty of tamarind water is given combined with sugar cane juice; recovery is noticed in some cases. The suspected poison is expected to be one of glucoside.

9. Seasonal Variations in HCN Content of some common crops and Tree leaves.

N. D. KEHAR and L. V. I. N. SASTRY, Izatnagar.

It has been observed that most of the so far known poisoning cases of livestock in India, are due to prussic acid. Observations were, therefore, made to find out the variation in HCN content of crops every month from the time of sowing till the plant was dead ripe. The following crops (Summer and winter) were examined for their HCN content. Jowar, Bajra, Maize, Moong, Urd, Cowpea, paddy, Silmle, Groundnut, Til, Guar, Sanhemp, Patsan, Moth, Arhar, Barley, Alsí, Peas, Gram, Khasa, Sarsun, Wheat, Masoor, Oats and Taramira. The effect of Irrigation has also been studied. The HCN content has been noted to increase till the plant reaches its flowering stage, after which it decreases as the plant ripens. Winter crops are found to contain more HCN than the summer crops. In general, it has been observed that the samples from the irrigated village contained less HCN than the corresponding ones from the non-irrigated village.

In the case of tree leaves observations were started in the month of July and extended for a period of one year, the HCN being determined at monthly intervals. It appears that HCN is maximum in the month of March and minimum in the months of May and June. Amongst the leaves examined (Pakhar, Mango, Neem, Bargad, Beri, Babul and Pipal) Pakhar appears to contain the maximum and pipal the minimum amount of prussic acid.

10. A study of the Tubercle of Whitnall in the South Indian Skull.

A. ANANTHANARAYANA AYER, Madras.

This study is based on observations on eighty adult skulls, ten pairs of zygomatic bones of children, and a series of dissection of the orbit.

The orbital tubercle of Whitnall is present in 93 per cent of skulls, and is located at a point 1 cm. inferior to the fronto-zygomatic suture. In very young children the tubercle is not marked and it gradually forms during childhood and adolescence.

Frazer (1940) considers that the attachment of the lateral check ligament is responsible for its formation. The present writer disagrees from the view. It is noted that the orbital tubercle is absent in Primates lower than man; and that it comes into form and size during childhood. The direction of the tubercle as represented by a normal at its apex is medial and not backwards. The author's dissections show that the lateral retinaculum of Hesser is not compacted to a cord at the point of attachment; and hence it seems as if the individual moieties of the ligaments constituting the lateral retinaculum could produce varying pulls at different parts of the area of attachment. The author puts forth the suggestion that the lateral palpebral ligament is mainly responsible for the formation of the tubercle and that this strain on the lateral palpebral ligament is itself dependent on the establishment of binocular vision in men with its concomitant convergent accommodation.

11. Precursin for the qualitative replacements of blood and treatment of Tuberculosis.

J. N. MISSRA, Waini

Precursin is the medical name given to the red precursor of the like of Etioporphyrin found in the Chlorophyll II of plants. This is related to haematin of the human blood. Etioporphyrin molecules within its constitution has pyrol groups which forms Chlorophyll by a chain reaction.

The chloroplastic red pigment being glucoside in nature and formed under the conjoint acting of alkalies and oxygen is exactly like our arterial blood pigment. Thus the qualitative replacement of blood can be effected by the use of precursin. Considering the important action of Precursin on cod liver oil, I am inclined to believe that when the substance is circulating in blood in the pulmonary area and while imparting its colour, emulsifies the fatty contents of T. B. by virtue of its alkalies. Precursin is being given subcutaneously at present. The effect of this substance on the T. B. patients has been studied which shows encouraging results. Further investigations are in progress.

PHARMACOLOGY AND THERAPEUTICS

12. The Intestinal Excretion of "Phthallidine" and "Suxidine."

A. N. BOSE and P. C. RAKSHIT, Calcutta.

From a study on sulfaguaniidine, sulfabenzide and sulfathiazole it has been shown by Bose, Ghosh and Rakshit (1946) that the efficacy of the Sulpha drug in the treatment of bacillary dysentery would depend to a considerable extent on its higher water solubility as this would have a greater chance of reacting the affected tissues. But as phthalyl—and succinyl-sulfathiazole (phthallidine and suxidine respectively) are known to have definite action against dysentery organisms without being so soluble in water *in vitro*, the mode of their intestinal excretion has been studied and the bearing of this has been discussed in relation to Marshall's hypothesis on the mode of action of sulpha drugs against intestinal infections.

In order to throw further light on the problem the bacteriostatic action and excretion of the succinyl sulphanilyl benzamide is also being studied.

13. On the Specificity in the action of Penicillin.

MARIAM GEORGE and K. M. PANDALAI, Bangalore.

The Gram sensitive nature of antibiotic substances is now one of their well-recognized properties. Due to the increased significance of the recent finding that the presence

of Mg. ribo nucleate is one of the criteria deciding the Gram nature of the pathogen, experiments were projected to examine the influence of this substance on the nature of penicillin inhibition on gram-negative organisms. As a result it was proved that Mg. ribo nucleate stood to gram-negative pathogens in the same relation as did ordinary nucleic acid to the gram-positive pathogens in that the added Mg. ribo nucleate antagonized the inhibitory action of penicillin on gram-negative organisms and also allowed the organisms to grow from the non viable condition rendered by contact with penicillin. The results however indicate that the addition of Mg ribo nucleate to cultures of insensitive gram-negative organisms does not help them to become susceptible to lower concentration of penicillin as would be expected. This means that Mg ribo nucleate alone cannot render a gram-negative organism allied in its nature to a gram-positive organism from point of view of susceptibility to penicillin is concerned. This, definitely shows that the specificity is a matter merely of experimental conditions and the concentration of the drug and that it can be adjusted by suitable modifications of the inhibiting environment.

The observations would also show that the Gram positive or negative character of an organism is a physiological property and depends primarily upon the differences in their metabolic reaction pathways.

14. A possible mode of action of penicillin.

M. GEORGE and K. M. PANDALAI, Bangalore.

The influence of the nucleic acids on the bacteriostatic action of penicillin was investigated in detail and the following conclusions have been reached.

Nucleic acids act as inhibitors of penicillin action. Thus parasites are able to grow even if they are in contact with penicillin provided the medium contained added nucleic acids.

Nucleic acids possess the power of restoring the viability of organisms which became non-viable after the contact with penicillin. The revived organisms grow and multiply normally.

The Gram-negative penicillin insensitive organisms under the influence of sub-lethal doses of penicillin undergo morphological changes chiefly the gram-staining characteristic. They become temporarily gram-positive.

Such gram reversing change was later found to be a fundamental one for all organisms under the influence of penicillin, for example, *Staph aureus*, *Strepto-hæmolyticus* and *B. dysenteriae* underwent temporary gram reversals. This means that penicillin bacteriostasis is always preceded by morphological changes, especially the Gram-staining character.

It was also observed that in the case of Gram positive organisms which underwent temporary Gram-reversal the organisms could be restored to the original form by added nucleic acids; but, that, nucleic acids did not possess this property of restoring the morphological form to the reversed gram negative organisms.

On the basis of this evidence, a postulate is made that penicillin interferes in the metabolic processes of the parasites particularly in the phases where nucleic acids feature either as metabolites, helping cell division, or function as respiratory catalysts or as both.

15. Action of amidopyrine on the hæmopoietic system.

C. R. DAS GUPTA and J. B. CHATTERJEE, Calcutta.

Amidopyrine in doses of 0.04 gm. and 0.1 gm. per kg. body weight was given daily

to two groups of Rhesus monkey for 6 and 5 months respectively. There were two monkeys in each group and the drug was given orally through a stomach tube.

Examination of blood was done at intervals of 10 to 14 days for total and differential white cell counts and at longer intervals for hæmoglobin, red cells, reticulocyte and corpuscular values. No significant change was seen in the hæmoglobin, red cell count, reticulocyte and corpuscular value but slight variation in the total and differential white cell count was occasionally noted in all the animals. No definite leucopenia or neutropenia was, however, noted in any of the animals at any time.

Even in the absence of any definite change in the blood values, bone marrow findings, obtained by tibial puncture, showed definite changes at the end of the experimental period. In all the animals of both the groups, definite hypoplasia of marrow was noted, with relative and absolute diminution of the cells of the granular series and of the precursors of red cell series. Relative increase of the cells of the non-granular white cell series was however noted in all the animals, but absolute increase of these cells was observed only in the animals receiving the smaller dose—0.04 gm./kg.

16. Chloroquine (SN7618) in malaria—A report on 50 cases.

R. N. CHAUDHURI, M. N. RAI CHAUDHURI and N. K. CHAKRAVARTY, Calcutta.

Chloroquine (SN 7618) is 7-Chloro-4 (4-diethylamine-1-methylbutylamino) quinolin derivative synthesised in the United States. Its properties are similar to those of mepacrine, but it possesses about three times its activity and does not colour the skin.

In this series 50 patients with active malarial infection were treated with this drug. Out of these, 18 were malignant tertian, 27 were benign tertian and one was quartan, while 4 had mixed benign tertian and malignant tertian infection. They were studied particularly with the object of finding out the time taken to control the fever, the time for the asexual parasites to disappear from the peripheral blood and side effects, if any.

The following two *schedules* of treatment were tried: (A) Two tablets (each containing 0.25 gm. of base) followed by one tablet after 6 hours and then one tablet on each of the two consecutive days—a total course of 5 tablets. (B) A single dose of 6 tablets.

Forty eight patients were above 12 years of age and received one or other of the above two schedules. Two patients under twelve years had proportionately less amount of the drug.

The average *effect of the treatment* has been (1) to bring the temperature to normal in 26.8 hours with regime A and in 26.4 hours with regime B, and (2) to cause disappearance of asexual parasites in 35 hours with A and in 31.5 hours with B. These results show that the drug is very effective in terminating an attack in a short time and is highly active against asexual parasites.

Twenty patients were under observation in the hospital for 15 to 30 days. None had a *relapse* while in the hospital. One case of malignant tertian and another of benign tertian malaria however came back with fever and homologous infection 30 days and 45 days respectively after the discharge from the hospital.

The *gametocytes* continued to appear or persist in the peripheral blood inspite of treatment.

Some *untoward effects of the drug* were observed in 5 patients. They complained of one or more of the following symptoms: insomnia, nausea and gastric irritation.

pruritus and pain in the lower abdomen and thighs. These side effects were obtained with both schedules A and B, and they disappeared in 2 or 3 days.

17. Effect of vitamins on the micro-organisms of angular conjunctivitis and chelitis.

G. PANJA, Calcutta.

The growth of Morax-Axenfelds' bacillus and Petit's bacillus isolated from cases of angular conjunctivitis and chelitis is markedly inhibited by B₂ complex (Riboflavin, nicotinic acid and yeast extract) and partially by vitamin B₁ but stimulated by vitamin A in liquid as well as in solid culture medium, whereas the growth of typhoid, dysentery and cholera organisms, Bact. Coli. Staphylococcus, Streptococcus, Pneumococcus, Anthrax bacillus, Proteus, and Pyocyanea bacilli is practically unaffected by riboflavin. The action of riboflavin is bacteriostatic only and not bactericidal. That the two above organisms of angular conjunctivitis are pathogenic is corroborated. Riboflavin alone given internally favourably influences the disease of its marked bacteriostatic effect on the organisms.

18. Parenteral Use of Sterile Sea Water in the treatment of Certain skin diseases.

K. N. OJHA and K. VENKATACHALAM, Cuttack.

The injection of sea water intra-peritonially as well as intravenously has been found to effect a complete cure of cases Sarcoptic and follicular manges in canine patients and also in Ringworm infection in bovine. (Capt. K. Venkatachalam and others).

It appears that the improvement of the mineral constituents of the blood by introduction of sterile sea water makes unfavourable conditions for the parasites to live in the skin tissues.

This prompted us to try sterile sea water in human skin diseases caused by parasites. About 70 cases of typical scabies and 10 cases of Ringworm infections and 10 cases of eczematoid lesions of the skin were selected and 3 c.c. of sterile sea water was given subcutaneously every day for 20 days.

Observations:—Itching which is so severe was absent after 3-4 days of injections and the lesions showed drying up gradually. In very mild cases the cure was within 10 to 12 days. In heavily infected cases repetition of another course was found necessary after some time. Eczematoid lesions became dry within a week and healed up gradually within 2-3 weeks. No toxic symptoms were noticed to occur. Further work is in progress.

19. Note on Lathyrism.

M. N. RUDRA and H. C. GHOSH, Darbhanga.

The result of treating Lathyrism patients with daily intramuscular injections of 0.5 mg. prostigmin "Roche" is described. Given in this dosage the drug appears to have very little effect in the patients' conditions. It is admitted that the given dose is only half of what is reported to be effective.

20. The Chemical Composition and therapeutic value of the juice of fresh leaves of Peepul (aswath) tree.

S. K. CHATTERJI and H. D. GANGULI, Calcutta.

The sacred tree known as Peepul tree (aswath) is widely distributed all over India, so naturally it may be assumed that beneficial effects in some form or other may be derived from every part of the tree. So far the root, bark and fruit of the tree have been tried. The fruit is said to be a laxative and helps digestion. The bark is astringent due to the tannin present in the bark. The seeds are also said to be cooling and refrigerent. The juice of root is said to be a good tonic.

The green leaves have a property which is not known to many. The poorer class of people, particularly in a village where not much medical help can be received, use the juice of green leaves of the tree for the treatment of diarrhoea. They use it even in cases of suspected Cholera and with successful result. About 1 teaspoonful of the fresh juice mixed with a little sugar is administered every hour till the vomiting and purging ceases. Noting this beneficial effect, the chemical composition of fresh juice of leaves was determined.

		Small leaves.	Big leaves.	Twigs (soft) without leaves.
		p.c.	p.c.	p.c.
1. Moisture and volatile matters ..	..	84.56	78.58	81.06
2. Ash .. ..	..	3.63	4.49	1.65
3. Organic matter .. ..	..	11.81	16.93	17.29
		<hr/>	<hr/>	<hr/>
	Total ..	100.00	100.00	100.00
4. Hydrocyanic acid .. ..	..	Nil	Nil	Nil
5. Total Nitrogen .. ..	..	1.5	1.5	0.98
6. Protein content .. ..	..	9.37	9.37	6.12
7. Alcoholic extract .. ..	..	4.2	4.6	2.8
8. Carbohydrates .. ..	..	7.6	13.9	14.4

9. The mineral constituents have been found to be mainly consisting of Sulphates, Phosphates and Carbonates of Sodium, Potassium and Iron.

10. There were also traces of other salts like—Magnesium, Calcium, Copper, Manganese and Aluminium.

This has only been a preliminary step towards the investigation of the action of juice of Aswath leaves.

Investigations are still in progress to determine the effect on Cholera patients and the result will be published in near future.

PATHOLOGY, MICROBIOLOGY AND PARASITOLOGY

21. Staphylococcal antihæmolysin in normal and diabetic sera.

G. PANJA and A. AHMED, Calcutta.

The sera of 80 non-diabetic and 15 diabetic patients were examined for Staphylococcal antihæmolysin. 8 M.H.D. of Staphylohaemolysin active in 1 in 128 dilution was used for the test. It was found that the presence of antihæmolysin was much less in diabetic blood than in normal blood. Not a single diabetic patient showed any antihæmolysin

when the serum was diluted 1 in 64 but in normal persons 2.7 per cent. showed the presence of antihæmolysin when the serum was so diluted. When the serum was diluted 1 in 4, 97 per cent. of nondiabetics showed antihæmolysin whereas 80 per cent. only of diabetics showed it. No antihæmolysin was detectable in normal sera when the dilution of the serum was carried to 1 in 1024. There was rise of antihæmolysin content in diabetic sera *pari passu* the fall of blood sugar during the course of treatment.

There was no appreciable difference in antihæmolysin-content before and after injections of Staphylococcal vaccine in non-diabetics, though there was generally a rise of agglutinin after injection. It is believed therefore, that the presence of staphylococcal antihæmolysin is a better index of staphylococcal immunity than the staphylo agglutinin.

22. Streptococcal Septicæmia in albino mice.

V. R. RAJAGOPALAN, Mukteswar, Kumaun.

Two outbreaks of streptococcal septicæmia in white mice were encountered during 1946-47 among the laboratory stock of mice.

The characteristic symptoms were dull and lustreless coat, hurried breathing, caseation of superficial lymphatic glands and ulceration and scab formation of the skin of the back. In some cases dry gangrene of the tail or swelling of one or both hind feet were noticed.

A hæmolytic streptococcus belonging to Lance field's group C was isolated from the lymph glands, heart blood and from all the internal organs.

The disease was reproduced in mice both by parenteral inoculation and by feeding of the cultures.

23. Utilization of ground-nut cake hydrolysate as medium for antibiotic production by micro-organisms.

R. RAGHUNANDANA RAO and P. R. VENKATARAMAN, Bangalore.

A study of some of the cheaper nitrogenous raw materials to find out their use as media for antibiotic production by micro-organisms was carried out. Enzymic digest of ground-nut cake was found to serve the purpose satisfactorily. The digest is prepared by hydrolysing powdered ground-nut cake with 2% papain for about five hours at 80°C. The clear filtrate has been used in the medium after adjusting the total solids to 2%. The filtrate was analysed for total solids, total nitrogen, non-protein nitrogen, basic nitrogen, amide nitrogen, amino nitrogen, tryptophane, tyrosine, cysteine, free nicotinic acid, total sugars, potassium, calcium, iron and phosphorous. Different members of the aspergilli like *A. fumigatus*, *A. ustus* and *A. calvatus* and also *Streptomyces griseus* gave good antibiotic production when grown in media containing the hydrolysate.

24. Relation between Antibiotic production by *Aspergillus Ustus* and source of nitrogen.

R. RAGHUNANDANA RAO, Bangalore.

Experiments were carried out to find the relationship if any between the source of nitrogen and antibiotic production by *Aspergillus ustus*. The sodium nitrate of the Czapek-Dox medium was replaced by other nitrogenous materials the amount of nitrogen however remaining the same. The sodium of sodium nitrate was incorporated in the media by the addition of an equivalent amount of sodium chloride. Sulphate, Chloride and nitrate of ammonia formed the inorganic nitrogen sources, urea, asparagine and glycine the organic nitrogen sources and wheat bran extract and enzymic digest

of ground-nut cake the complex sources. Antibiotic activity and pH of the culture fluids, and weight of mycelial growth were found out daily. The experiment showed that complex sources of nitrogen favoured antibiotic production, whereas simpler sources, both organic and inorganic, favoured acid production. Growth was however more in the simpler sources.

25. The Role of Iron in the Production of Tetanal Toxin.

M. K. K. MENON, Guindy.

The vital part played by iron in any medium used for the production of Tetanus Toxin has been recognised in recent years. Attempts were made in this laboratory to find out the optimum level that is conducive to production of a high potency toxin using *Clostridium tetani* as the strain and peptic digested beef broth as the medium. Micro-estimations of iron were made by using alfa Dipyrldyl, based upon the reaction of ferrous iron with this reagent. M. L. D. determinations were made on white mice on several batches of toxin. High potency toxins were consistently obtained when the iron level was kept at about 0.125 milligram per litre showing thereby that this is the optimum level.

26. Studies in Anthrax transmission.

B. C. BASU, Izatnagar.

The role of arthropods in the transmission of Anthrax is under investigation. Experiments were tried on guinea-pigs. The arthropods which are being tested are: *Musca* (mostly *nebulo*), *Culex*, sp., *Acdis albopicta*, *Anophelis annularis*, *Hæmatopinus tuberculatus*, *Hyalomma ægyptium*, *Argas persicus*, *Ornithodoros savignyi*, *Ornithodoros crossi*, *Ctenocephalus felis* and *Tabanus rubidus*.

Three types of mosquitoes, buffalo lice, *Argas* and *Ornithodoros* ticks and *Tabanus* flies failed to transmit the disease by interrupted feeding (i.e., half feeding on an infected guinea-pig and refeeding on a healthy one immediately afterwards). *Musca* flies (upto four hours through abraded surface). *Hyalomma* ticks and *Ctenocephalus* fleas could transmit the disease by interrupted feeding.

Survival of Anthrax organisms in the gut of the above arthropods have been studied. They survive upto forty hours in *Musca*, one hour in mosquitoes, forty-eight hours in *Ornithodoros*, fifteen days in *Argas*, forty-five hours in *Hyalomma* and twenty-four hours in *Hæmatopinus* and *Ctenocephalus*.

Culicine larvæ developing in water containing Anthrax spores yielded adults with guts non-infected with Anthrax. Anthrax organism survives for fourteen days (or longer) in the gut of earthworms, feed artificially with Anthrax spores.

NUTRITION AND BIOCHEMISTRY

27. Effect of prolonged administration of Intermediary metabolites on the blood-sugar level of rabbits.

M. C. NATH and H. D. BRAHMACHARI, Nagpur.

Sodium salts of the Intermediary fat metabolism products (viz., acetoacetic acid, B-hydroxy-butyric acid) while injected daily in the normal rabbits, gave rise to the condition of hyperglycemia after a certain period.

This state of hyperglycemic condition does not persist for long, and after a particular time the blood sugar values begin to fall down if the daily dose is not allowed to be increased.

By gradual increase in the doses of these compounds it has been possible to maintain a typical type of hyperglycemia characterised with decreased sugar tolerance as in case of clinical diabetes mellitus.

Glycosuria and acetonuria have been observed along with hyperglycemia in the animals receiving injection of gradually increased doses of B-hydroxy butyrate.

28. The test of detoxicating function of liver by sodium benzoate injection in normal and allergic states in Indians.

G. PANJA and S. BANERJEE, Calcutta.

Exactly one hour after an intravenous injection of 1.77 gm. of sodium benzoate (equivalent to 1.5 gm. of benzoic acid) dissolved in 20 c.m. of distilled water, the excretion of hippuric acid calculated as benzoic acid was tested by the method of quick allergic states such as atopic dermatitis, eczema, etc. In the normal group, all were adult males; average excretion was 0.701, the range varying from 0.23 to 1.22 as compared with the English figures, average 0.768, range 0.41 to 1.10 based on 20 females cases only; American figures—range 0.74 to 0.95. In the group with allergic states, the average excretion was 0.62, the range varying from 0.23 to 1.09 (33 adult males and 5 adult females).

The figures statistically examined show no significant difference between the control and the test cases, indicating thereby the possibility of absence of any role of the liver in its detoxicating function in the allergic states.

The average normal Indian figures are given in the paper.

MISCELLANEOUS

29. Note on Lall's nitric acid test for mustard oil.

M. N. RUDRA, Darbhanga.

Lall's nitric acid test has been found to be useless for detecting adulteration of mustard oil with *Argemone mexicana* oil.

30. Observations on Sera of normal population in Bombay.

MRS. S. D. SOMAN, Bombay.

Analysis of 1042 sera submitted to W. R. and Kahn and 6492 to standard Kahn test are presented. Of 1042 sera submitted to the two tests, discrepancies are noted in 25% of all reacting sera; this compares favourably with the findings of other worker. Of these 16.9% were due to W. R. +ve and Kahn -ve and 8% were due to W. R. -ve and Kahn +ve. The former is twice that of the latter in this series, while the results of other workers indicate that these two kinds of discrepancies are equal. This may be due to the smaller and selected number of sera submitted to both the tests in the present series. It is noted, however, that W. R. is more sensitive, i.e. 9.7% than 5.8% sensitivity of Kahn test. From the available history of cases it appears that most of the W. R. +ve are syphilitic cases and the discrepancies are mainly in these. The incidence of Kahn +ve is in conformity with reports of other workers.

Blood donors in other countries usually represent random samples of population and this accounts for a very insignificant, 0.75%, to 0.9% positive rate in general population (Br. Jour. of Venereal Diseases, June 1944). The sero-positive rate in blood donors in the present series is 5%. Greval, from his experience in Calcutta, states that sero-positive rate for the general population must be very low and the sero-positive rate indicative of syphilitic infection insignificant.

31. Cation-Exchange resins for recovery of Quinine.

N. KRISHNAWAMY RAO and K. VENKATARAMAN, Bangalore.

The serious shortage of quinine caused by the World War II has been sought to be countered by extending the area under cultivation. Improvements in methods of working the bark would offer immediate results.

Ion-exchange resins which can be used in acid medium can be employed for the recovery of quinine from acid extracts of the bark on a continuous cycle. The portable nature of ion-exchange units and the fact that the wet bark gives (Applezing 1944) a larger yield of quinine makes it possible to work the bark in the plantations thus avoiding the troublesome process of drying and costs of haulage and powdering.

As a preliminary to investigating the possibility of employing such a method we decided to study the capacity (for absorption of quinine) of a resin prepared by one of us from a local tanning bark (*Cassia Auriculata*). Percolation of a weak (0.2%) solution of quinine sulphate through a column of the resin showed a capacity to "break through" of 11 gms. per 100 c.c. resin bed. Parallel experiments with an American product ("amberlite I. R. 100") gave a capacity of 13 gms/ 100 c.c. Organic solvents could be used for elution but we have found that aqueous ammonia is also satisfactory.

Further work is in progress to study the recovery from *Cinchona* bark and to investigate the possibility of evolving simple methods for the separation of quinine from the associated alkaloids.

32. Removal of fluorides from water.

K. VENKATARAMANAN, N. KRISHNASWAMY RAO and T. RAMAKRISHNA NAIR, Bangalore.

Fluorosis is endemic over several areas of our country. The main source of ingested fluorine appears to be the drinking water. While there is evidence that nutritional supplements can mitigate the severity of the symptoms, a more direct and practicable approach would be to reduce the fluorine content of the water.

A large variety of methods have been investigated from the point of view of our local conditions which make cheapness and simplicity of operation the more over-riding requirements. The use of paddy husk carbon treated with alkali and then with aluminium salts appears to be promising. The fluorine-containing water is merely percolated through a column of this carbon. The exhausted material can be regenerated by percolation of a solution of alum.

The following are among the other materials discussed: Bone, Bone charcoal, tricalcium phosphate, superphosphate, various carbons with and without activation, Aluminium phosphate, Aluminium silicate, natural clays, calcium aluminate, cation and anion exchange resins, and cation exchange resins charged with Aluminium ions.

33. The problem of brackish Water.

K. VENKATARAMANAN and C. P. NATARAJAN, Bangalore.

Rural areas and many urban area in the Presidency of Madras depend on wells for their supply of drinking water. In many areas where the wells yield brackish water, the problem of obtaining palatable drinking water is acute.

This problem can be approached in several ways viz (a) to seek an explanation for the occurrence in close proximity of fresh and brackish-water wells and to investigate if the adsorptive or other processes in the intervening soil play any part in the reduction of the brackishness of the water; (b) to investigate methods which would enable us to tap fresh water and avoid the intrusion of brackish springs and (c) to

devise simple methods of treatment to convert brackishwater into "sweet" water. The possibilities in each of these directions have been examined. A variety of materials have been prepared and studied for use as cation and anion exchangers. Resins obtained by condensation of the extract of tanning barks (*Cassia auriculata* & Wattle bark) with formaldehyde have shown good capacity which has not suffered on continuous use (with regeneration) over a period of 2 years.

34. A chemical test for detection of the active principle of *gloriosa superba* in human and animal tissues.

S. K. CHATTERJI and H. D. GANGULI, Calcutta.

Gloriosa superba an ornamental creeper plant, belonging to the N. O. Leguminosae is quite common in Bengal and in low jungles throughout India. Its flowers are used by the Hindus in the worship of "Shiva". The white juicy tuberous root which is more or less flattened or cylindrical in shape often 7-8 inch. in length and about 1 inch. in diameter (when fully grown) is considered as one of the seven minor poisons of sanskrit writers. It is often mistaken for aconite root and used as an adulterant of aconite. Besides, tannin and resin it contains a bitter principle which has been termed "Superbine".

It is known to have been used as a poison both as a suicidal as well as an abortifecient with fatal results. The symptoms were like those of an irritant poison viz., Nausea, Vomiting, diarrhæa, Convulsions, profuse sweating, coma, collapse and death. On post mortem examination the internal organs like stomach intestines, lungs, liver and kidneys were all found to be congested.

No definite chemical test for its detection in the human and animal tissues is to be found in any toxicological text books. Attempts had therefore been made to find out a suitable chemical test to detect the active principle of the plant in human and animal tissues in a fatal case of poisoning by it. Several experiments were conducted and the following results were noted:—

1. An acid chloroform mixture was found to be the most suitable agent for extraction of the poison from a sample of dried powder root.

(N. B. An acid or alkali ether extract or an alkali chloroform extract was not found to be suitable for the purpose).

The residue obtained on evaporating the acid chloroform extract of the dry powdered root was then tested.

- a. Taste — Bitter.
- b. Mayer's — Negative.
- c. With Hcl or H_2SO_4 — a deep yellow colour.
- d. With $H_2SO_4 + K_2Cr_2O_7$ — no colour.
- e. With $H_2SO_4 + KNO_3$ (crystals) — violet colour changing to red.
- f. With conc. HNO_3 — a deep violet colour with a yellow tinge appearing on the margin.
- g. With Fehling's solution — slight reduction.
- h. Injected to frog — proved fatal.

2. Powdered root mixed with minced meat, kept overnight then soaked in rectified spirit with a few drops of acetic acid for 24 hours and extracted by the Otto method using acid chloroform mixture and the residue tested. The same results were observed as above.

3. Powdered root mixed with minced human viscera (received from morgue from cases of natural death from injury)—kept overnight, then treated in the similar way as above and the residue tested—The same observations were made.
4. Powdered root mixed with minced human viscera + 0.2% HCl (soln.)—kept in an incubator for 24 hours at 37° C and then for 3 days at room temperature and treated in the same way as above.—The same observations were made — the nitric acid test gave a positive test though not so marked as in the dry powdered root.

Thus an acid chloroform mixture was found to extract the whole amount of the active bitter principle from the poison using Stas Otto method. It is not alkaloid in nature but a glucoside, fatal to a frog when injected to it, gives a positive colour test with HNO_3 with H_2SO_4 and $\text{H}_2\text{SO}_4 + \text{KNO}_3$ crystals.

Veterinary Section

Medicine, Pathology, Microbiology and Parasitology.

35. Blood picture in Ranikhet Disease of fowls.

G. L. SHARMA and C. SEETHARAMAN, Mukteswar, Kumaun.

In view of the scanty literature about the blood picture of fowls suffering from or infected with Ranikhet Disease, blood picture of fifteen healthy Rhode Island Red fowls, infected artificially with virulent strain of Ranikhet Disease virus, has been studied.

Blood of each fowl was collected from the heart, before and after the infection, and examined for (1) total erythrocyte count, (2) total leucocyte count, (3) corpuscular volume, (4) sedimentation rate, (5) differential count of white blood cells, and (6) hæmoglobin estimation. Total erythrocyte and leucocyte counts were made by using Toisson's fluid as a diluent; while making differential count of white blood cells, 'edge' and 'cross section' methods of examining smears were combined.

During the disease there is an appreciable fall (1) in total erythrocyte and leucocyte counts and (2) in the hæmoglobin percentage. The differential count shows a distinct rise and fall in the percentage of heterophiles and lymphocytes respectively.

36. Rinderpest in Dairy Cattle immunised with goatis.

P. R. KRISHNA IYER, Izatnagar.

A valuable stock of dairy animals (milch buffaloes, cows and young stock) property of Messrs. Govan Bros., Rampur were immunised against rinderpest with goatis in May 1945. Fifteen months later, many of these animals contracted rinderpest from the animals in the surrounding villages where this disease was raging and succumbed. Prompt serumisation of the entire farm stock followed by a second vaccination effectively put a stop to the disease.

Experiments at Mukteswar indicate that cattle immunised with goatis develop a life-long immunity. But this Rampur incident is not exactly in accordance with the findings at Mukteswar. The causes of the break-down in the immunity are discussed.

37. Infectivity by contact of Rinderpest Virus, including Goat-adapted Virus for Cattle and Goats.

C. SEETHARAMAN, Mukteswar, Kumaun.

Experiments were made to test the infectivity of rinderpest virus—both the virulent bull virus and goat adapted virus—from cattle to cattle and goats and from goats to cattle and goats, under ordinary field conditions and under conditions some of them admittedly artificial which would enhance the chances of transmission.

To represent various degrees of contact experiments were made in an ordinary cattle shed, in a small room of ten feet square, where still closer contact between healthy and infected was possible and in a trevis where the healthy and infected face each other at a distance which can be varied at will, the apparatus being covered with a thick tarpaulin so that the healthy inhaled the expired air of the infected.

The results of these experiments showed that a healthy bull infected with goat virus failed to transmit the disease in any case either to bulls or goats. However a healthy goat infected with goat virus was found to transmit the infection only to a healthy goat under very close contact as in the trevis. With the virulent rinderpest virus it was found that whereas transmission was possible from goat to goat and bull, transmission did not occur from bull to goat. It is concluded that there appears to be no danger of spread of the disease occurring through the use of goat virus in the field.

38. Ranikhet Disease outbreak at Izatnagar.

S. G. IYER, Izatnagar.

Ranikhet disease, caused by filterable virus, broke out on the Military Poultry Farm in the month of January 1946 and took a heavy toll of over 3,000 birds. None of these birds had been previously inoculated with the egg passaged vaccine. Almost simultaneously a few cases of Ranikhet disease were diagnosed in 3 pens on the Institute Farm adjacent to the above farm where 26 non-vaccinated and 22 vaccinated birds were present. More than 65 per cent. of the former succumbed to the disease but not a single vaccinated bird died.

39. Immature amphistomiasis in sheep in the Government Cattle Farm, Hosur.

P. R. KRISHNA IYER, Izatnagar.

The veterinary authorities in Madras were worried by an undiagnosed disease which occurred year after year among the flock of sheep at the Hosur Cattle Farm. The disease had a seasonal incidence from December to March and it was responsible for many deaths. The main symptoms were intermaxillary œdema, discharge from the nostrils and acute diarrhoea resulting in death in about a week. Post-mortem examination revealed acute congestion of the abomasum and to a lesser extent in the intestines.

Investigation by the writer conclusively proved that the disease was one of immature amphistomiasis. The lesions on the gastric and duodenal mucosa which were passed off for mere acute congestion were found to be uninterrupted congregations of immature amphistomes numbering about 200 to 500 per sq. inch imbedded on the inflamed mucosa.

40. Intestinal Trichomoniasis in calves.

N. S. SANKARANARAYAN, Izatnagar.

During the course of investigation of calf scour in a well organised farm the complaint was found to be not the classical white scour that generally occurs in young calves although the symptoms were identical. The disease started with diarrhoea, rise of temperature, slow feeding of milk, dysentery with discharge of mucus and blood and the

animal dying from exhaustion. The post-mortem lesions were mostly confined to the small intestines in the form of acute enteritis with ulceration and hæmorrhage. Liver was found affected to a certain extent. No complications as naval ill, joint ill or pneumonia which are common in white scour were present. Blood and organ emulsion failed to infect small animals. Series of microscopical examinations carried out revealed actively moving *Trichomonas* in fæces samples of sick animals, samples of water from water troughs and supply tanks. Sporadic cases of diarrhœa in bigger animals also showed similar flagellates which invariably disappeared either on recovery of the animals or when dysentery intervened. Treatment of the affected animal with an anti-protozoan drug gave relief with the disappearance of the parasites. The outbreak stopped practically with the cleaning of the well and the tank. Untreated cases were found to be affected by secondary bacterial invaders as *B. coli* and *pseudomonas aeruginosa* which were responsible for the dysentery and death. *Trichomonas intestinalis* although encountered in bovines and considered as non-pathogenic, from reports on this subject and from the above findings it is assumed that they are capable of causing intestinal disorders in calves under favourable conditions.

41. Stephanofilariasis among Buffaloes in Assam.

V. R. GOPALAKRISHNAN, Assam, Gauhati.

Details are given of investigation of Stephanofilariasis in buffaloes and of its occurrence as a specific cutaneous microfilariasis of the ear. The disease usually occurs sporadically but at times, it prevails in the form of an epidemic. Full particulars of its seasonal occurrence and localities affected are given.

Symptoms, course, means of control and treatment are described. The disease is generally confined to buffaloes. It is very rarely fatal though the incidence of affected animals in an outbreak varies from 20 to 50 per cent.

The casual parasite, both microfilaria and adult nematode, has been recovered from the lesions of ear-sore. The morphological characters of the parasite have been found hump-sore of cattle in India. The findings have been confirmed by Mukteswar Institute apparently identical with those of *Stephanofilaria assemensis* (Pande 1936), causing and by Officer-in-charge, Helminthiasis Scheme, Lucknow University.

Skin affections of cattle in India and elsewhere, caused by *Stephanofilaria* sp., are cited. The occurrence of *Stephanofilaria* sp. in buffalo—a different species of animal causing ear-sore, is recorded and its significance is pointed out.

Observations on certain identical features of hump-sore of cattle and ear-sore of buffaloes are discussed.

The work has been carried out under a scheme of research financed by the Imperial Council of Agricultural Research, India.

42. Johnes' Disease in Animals in the Madras Presidency.

G. R. VISWANATHAN, Madras.

The incidence of this disease is known to exist in the two farms of Coimbatore and Hosur for a very long time. The incidence of the disease in the following other places also are on record namely Bangalore, Military Dairy farm, Wellington, Central jail Vellore, in Mangalore, Ooty dairy, Nanjanad farm and also in Devakottah. The disease has been known to occur in cows, heifers, bulls, bullocks, buffaloes, sheep and rams. The disease runs a very acute course after parturition. Remarks are offered concerning the spread and control of the disease. Investigations are in progress concerning the breed susceptibility of cattle, their sex and age.

43. Bovine Tuberculosis in the Madras Presidency and its Diagnosis by Tuberculin test.

G. R. VISWANATHAN, Madras.

Organised attempts in Madras to find out the incidence was made by the author only in 1934. The method adopted from 1934 to 1936 was single intradermal method and from 1942 to 1947 it was double intradermal method. 514 animals were tested by the single intradermal method, only 4 gave suspicious reaction, while the rest were negative. This was done in the mofussil. From the results obtained, it would appear that the incidence of the disease in smaller towns of this presidency is rather rare. The number tested is so meagre as to have any definite conclusion. In Corporation cattle about 37 per cent. infection detected. An account of the comparative incidence in the Ongole and Mysore cattle is given. The variations in the percentage of infection in the different depots of the Corporation are noted. Post-mortems conducted together with the results are furnished.

44. Some observations on Avian Pasteurellosis (fowl cholera) outbreaks.

S. G. IYER, Izatnagar.

Fowl cholera (avian pasteurellosis) first broke out in the Institute's poultry farm in 1940. It re-appeared in the subsequent years causing the death of only a small percentage of the stock during each year. Although the first cases of the disease occurred during the hot summer months in all the years, the incidence was greatest during the monsoon period (July to Sept.). There were thousands of chickens in the brooder houses on the same farm but the disease has not occurred in them, the cases mostly occurring in the rearing pens. In some pens (rearing) only one or two birds died while in others 50 per cent. of the stock was wiped out within 2 weeks from the commencement of the outbreak. Recurrence of the disease on the farm year after year is attributed to the existence of "carriers" in the flock.

Methods for diagnosing the condition are described.

Serum and Vaccine inoculations were carried out and the results indicate that there is considerable scope for improvement in the preparation of these products.

45. Investigation on Contagious Abortion in Goats with Special Reference to Isolation of *Brucella Abortus* (Bang) from Goats' Milk.

P. R. NILAKANTAN and P. G. PANDE, Mukteswar, Kumaun.

Brucellosis amongst goats at the Government Livestock Farm, Hissar in the East Punjab, was investigated by blood serum agglutination test and by cultural examination and guinea-pig inoculation of the infective materials including milk.

Brucella abortus (Bang) was isolated from 3 out of 5 guinea-pigs inoculated with milk samples from different goats whose blood serum gave positive reaction on agglutination test for *Brucellosis*. The following methods were used for identifying the type of *Brucella* involved:—growth under 10 per cent. CO₂ tension, growth on Huddleson's dye media, H₂S production and agglutinin-absorption test.

This is the first authentic record in India of natural infection of goats with *Br. abortus* and is an addition to the meagre information available of *abortus* infection in goats.

46. Application of allergic test in the detection of latency of surra in bovines artificially infected with *Trypanosoma evansi*.

H. N. RAY, Mukteswar, Kumaun.

In this article the author for the first time describes in detail some experimental observations made on the utility of allergic test in diagnosing latent surra. (*T. Wansi* infection) in cattle.

White rats were used for the yield of *Trypanosoma evansi* for preparing antigen. 0.1 c.c. of a dilute suspension (1/4000) of dry surra antigen made in saline was introduced intradermally and the reaction noted between the sixth and ninth hour. In positive cases there was a typical swelling which was characterized by heat and pain while the negative controls no such reaction was evidenced. At the end of 24 hours the swelling persisted in the positive ones while in the negative cases the site of inoculation was almost completely obliterated.

The utility of this test in the control of surra in this country has been discussed.

47. Application of Electrocardiogram in Animal Husbandry.

D. N. MULICK, Izatnagar.

Electrocardiogram is used extensively in the health and disease in human beings but little work has been done in animals. Experiments were therefore undertaken in sheep. In one group the thyroids were removed by operation. Daily E K G records were taken in experimental and control groups for 13 weeks. All the waves of P Q R S and T gradually decreased with time. The heart beat was slowed down. At this stage the thyroidectomised animals were supplimented with synthetic thyroprotein and the control was fed with thiouracil, a thyroid depressing drug. In thyroprotein group, the potential of all waves returned to normal within a week, with an increase in heart beat. The thiouracil group showed a decrease in heart rate with increase in potentials of Q R S and T.

Physiology, Nutrition and Biochemistry.

48. Factors affecting temperature records of domesticated animals in health.

N. S. SANKARNARAYAN, Izatnagar.

In recording body temperature of healthy animals if variations are noticed without manifestation of any clinical symptom, it was found mostly due to the faulty manipulation of the thermometer or spurious records of inaccurate instruments or to the temporary disturbances caused to the animal body by sudden change of its environment. To record the maximum unchanging temperature of healthy animals if the ordinary clinical thermometer is used it should be introduced in its full length leaving only a portion sufficient to hold with two fingers. This gave always a constant figure. Introducing the index finger along with the thermometer contributed to a great extent in reducing the rectal temperature and the subsequent record. Temperature recorded after exposure of animals to the sun was found to be always higher by 2 or 4 degrees than the normal depending upon the period of exposure and the nature of the sunlight. At least an hour's rest in the shade should be given before the correct figure is obtained. Watering reduces the temperature to an appreciable extent and the effect of watering remained for two hours in cattle and about one hour in horses and the correct record was obtained only after these periods.

49. Physiological studies on the blood of Domestic Animals.

Part II. Adult male buffaloes.

N. D. KEHAR and V. N. MURTY, Izatnagar.

In locating the pathological conditions, normal standards of the various blood constituents under different physiological conditions is extremely essential. In this article which forms the second of the series, observations on adult male buffaloes are presented. The blood was analysed for the following constituents. The maximum, minimum and the average figures are given:—Haemoglobin (6.1-9.3) Av. 7.7 gms. per 100 ml. blood. Red Blood Cells (4.4-7.2) Av. 6.1 millions per cmm. Cell Vol. (24.5-44.5) Av. 35.5 per cent.

Mean Corpuscular Vol. (52.2-67.3) Av. 58.4 cu.m.
 Mean Hemoglobin concentration. (11.0-14.2) Av. 12.7 rr.
 M. C. H. (19.6-25.4) Av. 21.8 per cent.
 Calcium (9.4-11.0) Av. 10.0 mg. per 100 mg. serum.
 Inorg. Phosphorus (5.76-7.84) Av. 6.95 mg. per 100 ml. serum
 Magnesium (2.14-3.45) Av. 2.76 mg. per 100 ml. serum.

50. Physiological studies on the Blood of Domestic Animals.

Part IV. Buffaloes calves.

N. D. KEHAR, C. V. RAO and V. N. MURTY, Izatnagar.

Samples of blood from six buffaloes calves were analysed from the birth to the age of one year at fortnightly intervals for morphological and chemical constituents. The calves were born with high blood sugar, Potassium, and calcium content. A gradual fall in these constituents has been noticed till the fourth month, and there-after remained almost constant. Magnesium, sodium, and chlorides gradually increased with age (5 to 6 months) till the sixth month. The low Inorg. Phos. at birth although higher than their dams, reached the peak level by the third month. The abnormally low serum proteins on the first day of birth, reached the maximum by the 1st week and maintained the level with slight fluctuations. The highest concentration of the Hb. R.B.C., C.V., and W.B.C., observed between 12th to 16th week, has shown a steady decline till 20th week, and remained steady at that level.

51. Physiological studies on the Blood of Domestic Animals.

Part V. Goats.

V. N. MURTY and N. D. KEHAR, Izatnagar.

In view of the scarcity of any data on the composition of the blood of goats, a systematic study was made on thirty growing, healthy young (9-18 months) male goats. The blood has been analysed for the morphological and chemical constituents. The maximum, minimum and average values are given below:—

H.B (4.9-8.2) Av. 6.7 mg. per 100 ml. of blood.
 R.B.C. (8.0-15.9) Av. 12.7 millions per c. mm. blood.
 C.V. (19.9-36.9) Av. 29.8 per cent.
 M.C.V. (16.2-30.3) Av. 23.6 Cu. m.
 M.C.H. (4.3-6.6) Av. 5.3 r.r.
 M.C.H.C. (18.4-26.8) Av. 22.7 per cent.
 W.B.C. (10.2-21.8) Av. 15.5 thousands per c.mm.
 Serum Proteins (4.2-9.2) 6.86 gms., per 100 ml. serum.
 Sugar (63.6-105.8) 83.5 mgms. per 100 ml. serum.
 Ca. (9.2-11.8) 10.3 mgms. per 100 ml. serum.
 Inog. Phos. (3.4-9.9) 6.5 mgms. per 100 ml. serum.
 Mg. (1.8-3.2) 2.5 mgm. per 100 ml. serum.
 Na. (230-541) 431 mgm. per 100 ml. serum.
 K. (11.3-20.8) 14.1 mg. per 100 ml. serum.
 Chlorides (404-468) 437 mg. per 100 ml. serum.

52. Physiological studies on the Blood of Domestic Animals.

Part VI. Kumaoni Bullocks.

V. N. MURTY and N. D. KEHAR, Izatnagar.

In view of the paucity of knowledge on the blood of bullocks and its importance in physiological and pathological studies, a systematic work on the blood composition of twenty four healthy kumaoni bullocks has been carried out. The average normal figures and the range of the following constituents is given below:—

Hb. (6.2-9.2) 7.4 gm. per 100 ml. blood.

R.B.C. (4.4-8.4) 6.5 millions per c.mm.

C.V. (24.6-46.2) 35.3 per cent.

M.C.V. (43.4-63.5) 54.6 Cu. m.

M.C.H. (10.1-14.3) 11.6 r.r.

M.C.H.C. (19.-25.3) 21.2 per cent.

W.B.C. (6.4-11.9) 8.4 thousands per c.mm.

Ca. (9.4-11.4) 10.5 mgm. per 100 ml. serum.

Inorg. Phosphorus (4.8-8.3) 6.8 mgm. per 100 ml. serum.

Mg. (1.71-3.19) 2.35 mgm. per 100 ml. serum.

Na. (253-489) 369 mgm. per 100 ml. serum.

K. (11.9-16.5) 14.0 mgm. per 100 ml. serum.

Chloride (344-412) 385 mgm. per 100 ml. serum.

Serum Proteins (5.1-8.9) 6.79 mgm. per 100 ml. serum.

Sugar (70.6-102.3) 88.1 mgm. per 100 ml. serum.

53. Hæmatological observation in Indian sheep and goat.

D. P. MUKHERJEE and P. BHATTACHARYA, Izatnagar.

Previously observations were recorded on the correlation of seasonal influence on semen characteristics and some blood constituents, hæmoglobin and cell volume in bulls. It was desired to continue this study on sheep and goats as well. As no normal data regarding the blood compositions of Indian breeds of these species are available, a study was undertaken to determine these morphological constituents.

Bi-weekly examination of blood samples have been made from nine sheep and eight goats from August 1946 to July 1947. Standard methods were employed in determining the constituents. The period of observations have been divided into four seasons that is, autumn, winter, spring and summer. Season wise the mean values of hæmoglobin and cell volume of goat are 6.24, 6.53, 6.91 and 6.66 gm. per 100 ml. of blood and 30.41, 30.60, 31.39 and 30.97 per cent respectively. In sheep the values are 6.91, 7.76, 7.87 and 7.69 gm. per 100 ml. of blood and 32.99, 33.86, 34.79 and 34.32 per cent respectively.

54. Copper Content of Blood and Tissues of Normal Kumauni Bullocks.

K. SAHAI and N. D. KEHAR. Izatnagar.

Copper content of blood, liver, spleen, bonemarrow, lymph gland and pancreas of normal kumauni bullocks ranged between 0.135—0.153, 160.6—200.1, 15.6—19.2, 24.6—28.8 and 19.2—24.0, with an average of 0.141, 173.6, 17.2, 26.6, 37.1 and 22.0 mg. per kg. respectively. The results indicate that of all the tissues examined liver is the richest and spleen the poorest in copper. In the descending order of copper content, liver is followed by lymph gland, bone-marrow, pancreas and spleen. The copper content of blood of kumauni bullocks has been found to be within the range obtained for the blood of man and most of the other animals. The high copper content of liver suggests that this organ is the chief storage centre of copper in the animal body.

55. Minimum and optimum Copper Requirement of Kumauni Bullocks.

K. SAHAI and N. D. KEHAR, Izatnagar.

The minimum copper requirement of kumauni bullocks, calculated from three sets of animals fed at different levels of copper, ranged from 6.56 to 6.87 with an average of 6.69 mg. of copper per 100 lbs. live weight per day. It was observed, however, that optimum results from a feed consisting of wheat straw and rape cake were obtained when the intake of copper by supplementation with copper sulphate, was raised to 7.38 mg. per 100 lbs. live weight, per day, which is about 10 per cent higher than the minimum requirement level. This has been termed the optimum copper requirement of kumauni bullocks.

The concentration of copper in the feed, calculated on the basis of the ingestion of copper and consumption of dry matter corresponding to the minimum and optimum copper requirement of kumauni bullocks, works out at 7.3 & 8.0 p.p.m. of the ration on dry weight basis.

56. Fishmeals as Cattle-feed ; Digestibility and Nutritive value of Fishmeals

S. S. NEGI and N. D. KEHAR, Izatnagar.

In India fishmeals are not economically used at present ; nor do we possess sufficient information with regard to their nutritive value.

The nutritive value of two fishmeals, *viz.*, salted mackerel and beach dried manthai, was determined by feeding these meals, with wheat *bhoosa* as roughage, to kumauni bullocks. It has been found that in general the animals start relishing the meal after three or four days. The digestibility coefficients of the two main constituents *e.g.*, crude protein and ether extract were 60 and 114 respectively for salted mackerel and 68 and 82 were the corresponding values for beach dried manthai. In salted mackerel the D.C.P. D.E.E., T.D.N. and S.E. per 100 lbs. of the material were found to be 37.95, 6.40, 52.4 and 50.1 respectively and in beach dried manthai the respective values were 48.93, 2.93, 55.4 and 52.5.

57. Investigations on Famine Rations : Jaman seed as a Cattle feed.

N. D. KEHAR and KARTA SAHAI, Izatnagar.

The chemical analysis of Jaman seed indicated that it is fairly rich in crude protein and the calcium content too is fairly high.

Adult kumauni bullocks were fed on wheat straw and a concentrate mixture consisting of 3 parts of jaman seed and one part of rape cake, for a period of thirty weeks. These adult animals which ordinarily maintain weight, gained on an average about 32 lbs. on the experimental ration.

Results of a metabolic experiment showed that the animals were on a high positive balance with respect to nitrogen. The balance for calcium and phosphorus too was positive. The digestibility coefficients of crude protein, ether extract and total carbohydrate were 68.5, 72.2, and 60.3 respectively. The digestible nutrients and starch equivalent per 100 lbs. of dry matter were found to be 45.5 and 45.1 respectively. This B. V. of the protein worked out at 84.3.

These observations give jaman seed a fair place in the list of concentrates. The digestible protein is fairly comparable to other seeds and grains, and jaman seeds can be satisfactorily used to replace oil cakes to the extent of at least 75 percent. The keeping quality of the seeds seems to be satisfactory as no deterioration took place even after twelve months storage. It is believed that this new source will provide several million maunds of concentrate food for cattle every year.

58. Investigations on Famine Rations: Groundnut Husk as Cattle feed.

N. D. KEHAR and L. V. L. N. SASTRY, Izatnagar.

Acacia Arabica grows extensively over a large area in India. Its pods are not economically utilised and much less the seeds. On chemical analysis the crushed pods were found to contain 14 per cent crude protein, 1 per cent calcium and 0.17 per cent phosphorus. Digestibility trials on Kumaoni bullocks indicated that the digestible protein, starch equivalent and total digestible nutrients are 10.5, 64.3 and 75.5 lbs. per 100 lbs. respectively. The metabolism trial also shows that the animals are in positive balance with respect to nitrogen calcium and phosphorus. Morphological and chemical examination of the blood of animals fed on acacia pods for a long period, showed no deviation from the normal values. These observations place acacia pods in the category of concentrates like gram, maize etc. for livestock.

59. Investigations on Famine Rations: Acacia pods as Cattle feed.

N. D. KEHAR and S. S. NEGI, Izatnagar.

It was suggested whether groundnut husk, major portion of which is thrown away as a waste could be used for feeding cattle. On chemical analysis the husk was found to contain crude protein 6.56, crude fibre 66.31, N. F. E. 22.16, lime 0.27 and phosphate 0.20 per cent. It was found that groundnut husk would not be consumed to form the total roughage quota and hence the ration including a concentrate, was so formulated that wheat *bhoosa* formed approximately one third of the total roughage supply. Feeding trials with Kumaoni bullocks indicated that the digestibility coefficients of crude protein, crude fibre and N. F. E. were 25, 19 and 41 respectively. The digestible nutrients in lbs. per 100 lbs. of the dry husk were: D. C. P. 0.91, D. C. F. 12.60, D. N. F. E. 9.21, T. D. N. 23.82 and S. E.—14.76.

The low digestibility of crude fibre and hence the negative starch equivalent may be due to the complex deposition of lignin in the cellulose structure. Further work aiming at the loosening of the ligno-cellulose complex is in progress.

60. Investigations on Famine Rations, Bawar (*Cassia Tora*, Linn.) Seed as concentrate feed for livestock.

N. D. KEHAR and V. N. MURTY, Izatnagar.

Bawar which grows in abundance during the monsoon months is not economically used. Its seeds were analysed toxicologically for the various toxic principles and chemically for the organic and inorganic constituents. This chemical composition of the seed showed that it contained 21.12 per cent of crude protein, 7.75 per cent of ether extract, 64.5 per cent of total carbohydrates, 5.50 per cent of sol. ash, 1.22 per cent of CaO and 1.62 per cent of Fe_2O_3 . The seeds are not relished if they are fed as a single concentrate, but when mixed with rape cake in equal proportions, the animals get soon accustomed to it and develop a taste after a few days. Digestibility trials conducted on three kumaoni bullocks showed the following digestibility coefficients:—crude protein 78.8, ether extract 88.1, total carbohydrates 42.5, 54.3, Starch equivalent, 59.4, total digestible nutrients. The digestible nutrients per 100 lbs. of dry seeds are:—crude protein 16.64 lbs. ether extract 6.83 lbs. total carbohydrates 27.41 lbs. These observations indicate that Bawar seed is as good as some of the ordinary cakes eg (cocoanut, linseed).

Bawar seeds were fed at the rate of 50% of the total concentrate mixture for a period of five months without any adverse effect on the health of the animals. During the latter part of the feeding period, a detailed study of the blood composition was carried out, and it was found that the blood of these animals did not in any way vary from those of the normal animals.

61. Further study on seasonal variations of semen in goats.

D. D. SHUKLA and P. BHATTACHARYYA, Izatnagar.

As a result of further works it has been found that 'reaction time' was highest in winter and during the rest of the seasons it was fairly uniform. On an average the semen samples were thick creamy during winter and spring and thin creamy during summer and autumn. Average size of the ejaculate was largest in summer and smallest in winter. Initial motility score did not show any marked difference between seasons. pH was slightly higher in autumn than during the other seasons. Average sperm concentration and total number of spermatozoa per ejaculate, were highest in spring and lowest in autumn. Average percentage of abnormal spermatozoa was highest in winter and lowest in autumn.

Results obtained during this period, which are in agreement with the previous years findings, show that spring was marked with the best quality of semen and autumn the worst.

62. Further observations on seasonal variations in semen, and hæmoglobin and cell-volume contents in the blood of bulls.

As a result of further works it was observed that during autumn and summer the average semen samples were thin milky and during spring and winter, milky. The average initial motility, number of spermatozoa per c. c., total number of spermatozoa per ejaculate, percentage of hæmoglobin and cell-volume contents in the blood was highest in autumn. The average percentage of abnormal spermatozoa was highest in winter and lowest in summer. There was no marked difference between seasons in 'reaction time' and pH. of semen.

On the whole the quality of semen as well as blood was observed to be best in spring and worst in autumn which is in agreement with the last year's finding.

63. Further study on seasonal variations in the semen of sheep.

D. D. SHUKLA and P. BHATTACHARYYA, Izatnagar.

As a result of further works it was observed that the 'reaction time' was highest in summer and lowest in winter. The average volume of semen produced was comparatively higher during spring and summer than in autumn and winter. Colour and consistency of semen was thick creamy during winter and spring and thin creamy in summer and autumn. Initial motility was somewhat steady throughout the year. Average pH was slightly higher in autumn than during the rest of the seasons, average concentration of spermatozoa was highest in spring and lowest in autumn. The average total number of spermatozoa per ejaculate was at high level during spring and winter and markedly low in autumn. Percentage of abnormal spermatozoa reached the peak in winter; there did not exist any wide variation in this characteristics during the other seasons.

In confirmation of the results obtained last year, it was observed that majority of the semen attributes under study were at their best in spring and worst in autumn.

64. Further observations on augmentation of fertility in cows and she-buffaloes by PMS.

S. N. LUKTUKE and P. BHATTACHARYYA, Izatnagar.

Attempts have been made to induce oestus and ovulation in 36 animals consisting of 19 buffaloes, 10 cows, 4 buffalo-heifers and 3 heifers and the results obtained have

been presented in this paper. These animals had not shown any symptoms of heat for more than four months since the last calving and at the time of treatment were found to have anoestrus ovaries excepting in one cow where a persistent corpus luteum was ordinary present. In 14 animals, the PMS prepared in our laboratory was used; in the remaining ones two proprietary preparations, Antostab and Gestyl were tried. The route of administration was either subcutaneous or intramuscular and the dosage varied between 1000 i.u.—2000 i.u.

Out of 36 animals, 5 cows and 12 buffaloes were slaughtered 4-26 days after injection. All the animals except one cow and two buffaloes exhibited clear signs of heat 3-9 days after injection. Ovulation occurred in 4 cows and 8 buffaloes. Twin ovulations had occurred in one cow and one buffalo. Both the ova were recovered from fallopian tube washings in case of the cow and only one ovum in case of the buffalo. The ovum was also recovered from the fallopian tube of another buffalo.

65. Preliminary report on the field application of Artificial insemination in India.

P. BHATTACHARYYA, Izatnagar.

The report deals with the first 13 months data collected from the 3 artificial insemination centres.

Montgomery, (Punjab).—At this centre a total of 1560 inseminations from 307 collections were performed. The average volume of semen collected per ejaculate was 3.8 c.c. for cow bulls 2.46 c.c. for buffalo bulls and 0.9 c.c. for rams. The average number of animals inseminated from each ejaculum works out to 4.9 for cows, 5.4 for buffaloes and 4.2 for rams. The cow-bulls gave an average over-all fertility of 76.6%; buffalo-bulls 70.7% and rams 85.8%. These figures are more than those obtained through natural service.

Inseminations were performed using both neat and diluted semen of different ages. It was noticed that diluted semen gave as good results as those got from neat semen. Results from preserved semen are available. The fertility obtained was comparable with that got from fresh semen and it varied from 70 to 81%.

Similar observations have been recorded for Patna and Calcutta centres.

In addition the report discusses the various difficulties encountered in practice in the field and how they could be overcome.

THERAPY

66 Vaccination Against Johne's Disease by Premunition.

P. C. NAG, Mukteswar.

The value of vaccination against Johne's disease by premunition in cattle has been well recognised in France but no such work is taken up in this country, where this sad disease is responsible for great economic loss to our livestock. In this article the author describes in detail his method of premunition and ultimate protection of cattle against Johne's disease in France and discusses the possibility of following similar procedure in this country. Experimental observation carried out so far in this country has given encouraging results.

67. Studies on Sterne's anthrax Vaccine.

V. R. RAJAGOPALAN, Mukteswar, Kumaun.

When virulent strains of *B. anthracis* are streaked on 50 per cent serum agar

plates and incubated in an atmosphere of 10 to 30 per cent CO₂, smooth mucoid colonies develop. On further incubation the smooth colonies throw out rough peripheral outgrowths. This variation from smooth to rough is irreversible and is accompanied by loss of virulence but with retention of immunising properties. (Sterne, 1937).

Vaccine (spore suspension in 50 per cent glycerine saline) made from such rough variants was potent and safe for use in cattle buffaloes, horses, mules, sheep, goats, camels and elephants.

A dose of 1500 spores conferred some immunity in sheep and 30,000 or more spores conferred a solid immunity.

If used at a dose of 1 million spores no saponin was required to enhance the immunity.

Solid immunity was established in 6 days after vaccination. The immunity lasted for about 3 months and then it gradually passed off until after one year very little immunity was detectable.

The strength of the vaccine, as judged by the viable count, fell to about 50 per cent in about one fortnight. No further marked deterioration took place over an observation period of one year. The vaccine was potent after a storage of one year and a half at temperatures of 5°C. to 30°C.

68. Studies in Chemotherapy of surra with new drugs.

B. C. BASU, Izatnagar.

Studies in testing the chemotherapeutic value of various drugs against surra were conducted. In every experiment control were kept. Four drugs, namely, Trypersamide, Neoarshphenamide, Neostibol and Paludrine were tested on guinea-pigs infected with *Trypanosoma evansi* with a single dose (intramuscular) of 0.1, 0.04, 0.01 and 0.41 grams respectively per kilo body weight as recommended by Dr. B. Mukerjee.

All these four drugs were found unsuitable as they could not stop the appearance of the trypanosomes in the peripheral circulation of the guinea-pigs nor could they save the animals.

59. Induction of Lactation in the Bovine by Administration of Synthetic Oestrogens.

S. N. LUKTUK and P. BHATTACHARYA, Izatnagar.

Attempts have been made to induce lactation in two nulliparous heifers and four dry cows of Haryana breed by subcutaneous implantation of small tablets and injections of Diethylstilboestrol. The heifers were matured but anoestrous and the cows were dry for a period of over two years and repeated inseminations failed to get them into calf. In one case the cow was dried off after the first induced lactation and the treatment was repeated in different dosage level during the second induced lactation. The total dosage varied from 250 mg. to 2000 mg.

No response was obtained in one cow and in another one where the heaviest dosage was tried the tablets had to be removed owing to the formation of abscess. The maximum daily yield varied from 3-11 lbs. and the total yield from 341 lbs.—1333 lbs. during a period of 112-262 days. The best response was obtained with a dry cow which gave a maximum yield of 11 lbs. daily and a total of 1333 lbs. in 161 days. This cow had given a maximum daily yield of 8 lbs. and a total yield of 1245 lbs. in 209 days during the first induced lactation and a total yield of 2910 lbs. in 307 days during the preceding normal lactation. No nymphomaniac syndrome was observed.

70. A study of the Bacteriological types of *C. diphtheria* present in Bombay.

D. W. SOMON and S. K. NAIL, Bombay.

This work was carried out for a period of nine months. Nearly 500 throat swabs were examined and cultured for the presence of *C. diphtheria*. 175 strains were isolated, out of which 167 were of the 'mitis' type, 7 of 'gravis' type and 1 belonged to 'intermediate' type. Cultures were done on Loeffler's serum and blood tellurite medium. Out of 127 cultures thus isolated, 93. 7% of the strains could grow on both media, 4% strains only grow on blood tellurite medium and 2.3% of strains on Loeffler's serum slope. On isolation, the morphology, colony appearance, haemolysin production and fermentation of usual substrates in addition to starch and glycogen were studied to determine the types. Virulence of 40 strains was tested in guinea-pigs by intradermal test and they were found to be virulent. One strain isolated from a cutaneous lesion from a patient was found to be avirulent.

SECTION OF ENGINEERING AND METALLURGY

President: N. SEN, M.MET., B.Sc., F.R.I.C., F.I.M.

1. Effect of Void on the Efficiency of Distillation in a Packed Column. P. L. JALOTA and S. K. NANDI, Bangalore.

In a packed distillation Column and in multitubular packed Columns (Selkar, Burk, Lankelma, Ind. Eng. Chem. Anal. Ed. 1940, 352) voids are present because of which some vapour passes without coming in contact with reflux resulting in channelling and decrease in efficiency but the advantage is low pressure drop with low holdup which is important when distillation under high vacuum is concerned. In the present paper some data are reported on the variation of column efficiency due to presence of voids.

A $2\frac{1}{4}$ " I. D. Copper tube was used as the column and the height of the packed section was 3'-7". For the packed column $\frac{2}{5}$ " diameter copper Lessing rings were used while for the multitubular column, six glass tubes each 43" long and $\frac{5}{32}$ " I.D. were put in the column, the remaining portions being filled with Lessing rings. The cross-sectional area of the void thus created in the multitubular column was 3% of the area of the column.

The rate of distillation was varied from about 8 cc. to 65 cc. per min. H. E. T. P. in the packed column varied from 8.7 to 10.75 inches for the system methyl alcohol-water, from 4.42 to 6.61 inch for ethyl alcohol-water and from 8.2 to 12.3 inch for Benzene-toluene while the corresponding values of H. E. T. P. in the multitubular columns varied from 8.3 to 11.46, 7.47 to 11.46 and 10.75 to 28.66 for the three systems respectively at different distillation rates. It will be seen that H. E. T. P. increases slightly with vapour velocity in the packed column but very rapidly in the Multitubular packed columns. This is due to the fact that the amount of vapour passing through the long glass tubes without coming into contact with the reflux increases as the vapour velocity is increased resulting in decreased efficiency. Thus the presence of voids in a packed column may not have any appreciable effect at low rates of distillation but the efficiency goes down rapidly as the throughput is increased. Manometers connected at the bottom of the still indicated less pressure drop in the case of multitubular columns than in the case of packed columns.

2. Periodic or Rhythmic Variation of the Intensity of Short Wave Radio Signals.

S. S. BANERJEE, G. C. MUKERJEE and R. N. SINGH, Benares.

In a few previous communications (Science & Culture, 11, 571, 1946; Nature, 158, 413, 1946; Proc. Ind. Sc. Cong. 1947, Sec. 3, Abs. No. 45) we have reported the observations made by us on fading of short-wave radio signals received at different hours of the day, and described, with possible explanations, the various patterns of fading obtained on those occasions. It may be mentioned that for reasons of their formation, the patterns of fading have been divided into two main categories of (1) random and (2) periodic types.

The present communication contains the results of detailed study of the periodic or rhythmic types of fading which are generally observed during the sunrise and sunset hours, and their significance for practical radio communication has been indicated. It has been shown by measurement of the angles of arrival of the downcoming waves that such periodic fading may occur due to interference caused by two waves reflected either

from one or two—different layers of the ionosphere, when one or both of them have slow vertical movement, presumably due to rapid change of ionization during the transition period of the layers. It has been further shown that the development of slow periodic fading may be due to the approach of maximum usable frequencies between the transmitting and receiving stations, and on such occasions the interference may be caused by magneto-ionic components of reflected waves as suggested by Appleton and Beynon (Proc. Phys. Soc., 59, 58, 1947). The above interference phenomena have been verified by recording the periodic fading of shortwave signals transmitted from Delhi on 16 to 41-metre bands at various hours of the day during different months.

3. On the underground water resources of Madras.

S. V. GANAPATI and O. T. RAGHAVAN, Madras.

Owing to unprecedented drought during the years of 1938 and 1939, the level of water in the only reservoir forming the then existing source of water supply to Madras became alarmingly low and in consequence severe restrictions were placed on the water supply and new sources to augment the old were sought. Two hundred and forty tube-wells, seventy bore wells and three twenty feet diameter wells were installed in the City besides renovating old, dis-used kitchen and garden wells attached to individual houses. The important chemical characteristic (such as the hardness, chloride and total solids) and the bacteriological quality of the three types of underground water resources as well as the hydro-geology of the soil overlying the water-bearing stratum are described.

4. On Double Filtration of an Impounded Surface water in Madras.

O. T. RAGHAVAN and S. V. GANAPATI, Madras.

A comparison of the modern methods of purification has been made possible, thanks to the labours of "The Committee on Water and Sewage Purification" appointed by the Madras Government for finding out the best method of purifying the water of the Red Hills Reservoir which has earned a name for itself as being the most difficult to purify satisfactorily. This Committee carried out experiments during 1927 to 1933, similar to those carried out by the late Sir Alexander Houston for the Metropolitan Water Board, London, on "Double Filtration" making use of (a) a rapid sand filter, (b) a coke filter and (c) a gravel sand filter, all receiving unaltered water, the secondary filter in each case being an ordinary slow sand filter. Besides, the Committee carried out experiments where (1) the prefilter was a rapid sand filter receiving either (a) alumed and settled water, or (b) alum and lime treated water followed by ordinary slow sand filtration at the slow (4 inch.) or semi-slow (6 or 8 inch.) rate, and (2) the prefilter was a percolating non-submerged filter using five different kinds of filter media followed by semi-slow sand filtration in each case.

The authors have compared the mass of analytical data (obtained from the above experiments), which are not readily available to the Water World.

5. Fifty years of public health and water supply practice in Madras.

O. T. RAGHAVAN and S. V. GANAPATI, Madras.

Freedom from diseases, abundance of wholesome drinking water available at all hours of the day and night and decent houses to live are sine qua non of public health of a village, town or city. The progress made in these directions is known only when one views retrospectively the conditions which existed in the previous decade or half-a-century. An attempt has been made in this paper to make statistical study of the Public Health of the City of Madras with special reference to the water-borne diseases and to correlate it with the water supply practice during the last fifty years (1897-1946).

6. A critical note on Puri Siltometer.

G. S. RAISINGHANI, P.O. Halani, Sind.

The study of silt charge and silt grade is one of the most important problems of canal engineering and river physics in the light of Lacey's Theory of Regime Flow. A large number of suspended and deposited silt samples is analysed mechanically with a view to assess 'm' value for substitution in the Lacey Formulae to construct Regime Flow Equations. Though the chief difficulty of mechanical analysis of coarse silts and sands was solved by Puri Siltometer on account of its simple and rapid working, some defects in its construction were noticed and some inaccuracies in the results of silt analysis were observed specially with regard to the influence of temperature on the reduced diameter size, effect of the bottom taper and the jerky rotation of the water trough carrying silt collecting cups on the silt size distribution, variation in the results of silt analyses on repetition, the influence of shape of silt particles on their rate of settling velocity, distribution of individual silt fractions in different silt collecting cups on re-analysis. A critical study of Puri Siltometer was undertaken by the writer in the Irrigation Research Laboratory of the Sind Public Works Department and the observations have been reproduced in the present note to illustrate the practical difficulties encountered in the working of Puri Siltometer so that this valuable instrument may be more serviceable in the most important work of silt analysis by suitable modifications, which have been suggested.

The paper is accompanied by Diagrams, Graphs and Statements showing results of Silt Analysis.

7. Output and other relations of Electronic Circuits.

RAMCHANDRA NATARAJAN, New Delhi.

The object of this note is to present the general output relations of electronic circuits from the stand-point of analytical geometry.

It is believed that analysis of electronic circuit with the use of Co-ordinate geometry throws into relief certain properties in the neighbourhood of the maximisation regions, not particularly evident from the corresponding inferences on Maximum from other methods. As the absolute conditions of maximisation hold good in practice only within varying degrees of departure, it is not irrelevant to be able to get picture of the Output characteristics more closely than hitherto attempted.

The analysis of the circuit is thus made to reduce to the study of the characteristics of the apposite conic. Interpretations of results are compared with otherwise known behaviours of such circuits.

It is believed that if a system of analysis is developed for tackling multi-stages circuit such as an amplifier or any communication circuit, it would help design. In this connection it may be pointed out that certain circuits show their conic sections as from a two-stage circuit of equally Murdened signal power as an envelope conic of the fundamental stage of the circuit and the Maximised Output Conic for this assembly is the tangential equation to the Output Conic.

Interpretation is, however, the essential part of this method of analysis.

8. Manufacture of Stainless Steel.

H. SRINIVASA SASTRI, Bhadravati.

Stainless Steels are manufactured in Induction Furnaces when very low carbon grades are required. Recently low carbon grades are also made in Arc Furnaces with Metrodyne control. The shaping of stainless steels of certain specifications is a difficult job. Many of the stainless steels are forged with difficulty into billets and then rolled. All the stainless steel ingots are machined to remove defects. After

machining they are closely inspected for roches and other defects and then despatched for heating for forging or rollings. Some of the steels are difficult to forge or roll and the operations are very carefully conducted. After forging or rolling the billets and slabs are again subjected to close inspection and all defects are removed by grinding and chipping. The billets and slabs are again preheated and transferred to heating furnaces and rolled to finished sections.

The finished sections are tested and subjected to careful inspection after heat treatment and picking. They are inspected after finishing operations and despatched to customers.

9. Nitrogen and Sulphur of Coke and its Composition.

M. P. GUPTA and A. T. BHATTACHERJEE, Jamshedpur.

From our studies on the elimination and introduction of nitrogen and sulphur in ordinary cokes and synthetic cokes it appears that:

- (1) Nitrogen and sulphur are present specially at lower temperatures in a state of ordinary absorption and are in a state of activation and with the rise of temperature they pass into a state of chemisorption.
- (2) The maximum absorption is in the region of 400° - 500°C and depends on the concentration of these two elements in the system.
- (3) With the rise of temp. above 400 - 500°C parts of the two elements are gradually eliminated but the major parts pass into a state of chemisorption.
- (4) Similar behaviour of coals in the process of carbonisation, suggests that the nitrogen and sulphur compounds present in coals, first decompose into their elementary forms which then attach themselves to the cokes formed in the way as stated above.
- (5) Part of S (adsorbed) in coke is removable by metallic sodium.

10. Sludging of Scrubber Oil.

A. T. BHATTACHERJEE and M. P. GHPTA, Jamshedpur.

It is a known fact that sludging generally takes place in such cases where straw oil (*i.e.*, higher fractions of petroleum oil consisting mostly of paraffin compounds) is used; the trouble is not so much in evidence where creosote oils are used. The view generally held is that this sludging is the result of the formation of polymerides from the unsaturateds present in the scrubbing oil. How far are the unsaturateds present in the gas responsible for this polymeride formation is not yet definitely known. With the view of ascertaining the cause for this sludging first of all a systematic investigation of the oil has been undertaken. From the investigations so far made it appears that:

- (1) The oil used in the scrubbers here contains a fair amount of unsaturateds.
- (2) Further quantities of unsaturateds are generated by the breaking up of the constituents of high molecular weights into those of lower molecular weights by cracking even at so low temp. as 120°C .
- (3) Both cracking and polymeride formation are responsible for the sludge formation, though the former plays the more important role by contributing solid carbon particles and increasing the amounts of unsaturateds as the process goes on.

11. A note on the Determination of Silica in Fluorspar.

H. P. SAMANTA, Jamshedpur.

The difficulties and sources of error in carrying out by the existing method the determination of silica in Fluorspar containing feldspar and other silicates are indicated.

Suitable modifications to the perchloric-boric acid method of decomposition (Schrenk and Ode, Ind. Eng. Chem., Anal. Ed., Vol. 1, 201, 1929) in order to make it applicable to this kind of ore have been worked out.

12. Determination of Tin and Rare-Earth Acids in Wolframite.

H. P. SAMANTA, Jamshedpur.

A study has been made of the various methods of determining Tin and rare-earth oxides (Colombium and Tantalum) in Wolframite. A method is proposed for the preliminary separation of tin and rare-earth oxides together from tungsten and subsequent estimation of the elements concerned. Results are found to compare favourably with the existing methods.

13. Investigations on Colorimetric Methods of Metallurgical Analysis.

Part VII—Spot tests for allowing elements in steel—Chromium and Manganese.

G. V. L. N. MURTY, Jamshedpur.

A comparative study of the diphenyl benzidine and the diphenyl carbazide methods for the detection and approximate estimation of chromium in alloy steels has been made and it is shown that the former is less suitable for low chrome steels (5%). Improvements have been effected in the diphenyl carbazide method, making it more elegant by employing the impregnated paper technique. Similar comparative study of the ammonium persulphate and the sodium bismuthate methods has been made for manganese. The sodium bismuthate method has been recommended with some modifications. The impregnated paper technique is shown to be suitable only for high manganese steels.

14. Studies on Rural Water Supplies.

K. SUBRAHMANYAN, T. R. BHASKARAN and C. CHANDRASEKAR, Calcutta.

Investigations were carried out for a period of 2 years on the quality of water drawn from tube wells and other sources of drinking water used by people in rural West Bengal and on the problems of maintenance of these sources in a satisfactory and safe condition. The investigation was confined to 2 Unions, 16.7 sq. miles in area with a population of about 27,000 using 315 drinking water sources.

The results show that tube wells of moderate depth can serve as satisfactory sources of water supply in rural areas with soil conditions similar to those obtaining in this area *i.e.*, over a large part of the Gangetic plain and delta. These tube wells yield water whose bacteriological purity is little affected by comparatively insanitary conditions on the surface, heavy usage or even by the use of polluted priming water. The soil around the wells gets compacted so as to cut surface contamination the prevailing chance of ground water wetting contaminated under the prevailing conditions of soil and usage. Examination of 3,586 Bacteriological samples from 134 tube wells spread over a period of 2 years show that a bacteriological standard of 10 coliforms per 100 c.c. in 80% samples is practicable. The standard appears to be consistent with absence of gastrointestinal diseases traceable to tube well water. The procedure for imposing these standards for rural tube wells is discussed.

With the cheap type of pitcher pump commonly used for tube wells in India, an efficient maintenance service is required. The data obtained on this aspect of the problem show that a public tube well needs on an average 2 repairs in a year, and that the total cost of maintenance of a tube well is about Rs. 8/- per annum. This money and an organisation for repairs should be provided for by the local authority of Government whenever tube wells are installed in rural areas.

Open shallow wells even when conserved by parapets, steining etc. yield water that is definitely inferior to tube wells in bacteriological quality. Evidence has been adduced to show that the bulk of the pollution introduced into the wells comes through the

top and through buckets and ropes. By covering the well and fitting it with a pump to draw water it is practicable to attain a standard of 100 coliform organisms per 100 c.c. in 75% samples. Data presented show that it is necessary to carry out further work before any bacteriological standard for this type of rural water sources can be determined.

15. Treatment of Strawboard Wastes by Trickling Filter.

K. SUBRAHMANYAN and T. R. BHASKARAN, *Calcutta*.

Disposal of wastes from a Strawboard Factory in Bhopal has been one of serious concern to the Public Health authorities of the State. The Factory is producing about 4,00,000 gallons of waste daily with over 2500 p.p.m. total solids of which 65% is organic and about 50% suspended. The pH of the wastes varies from 8.0 to 8.4. Water for dilution of wastes is inadequate in the locality and offensive conditions are produced in the lower reaches of the channel into which the effluent falls.

Various methods of treatment of the wastes have been tried. Addition of chemicals such as alum, iron-salts and sulphuric acid was tried for coagulation of suspended solids. Only sulphuric acid was somewhat effective but the dose required for was 2,000 p.p.m. i.e., 4 to 6 tons of H_2SO_4 per day and this is impracticable. Bubbling of flue gas (which is easily available in the factory) through the wastes at ordinary room temperature was tried, but this did not prove useful.

An experimental trickling filter $2' \times 2' \times 6'$ has been designed to determine whether the wastes could be handled by trickling filter treatment. The design provides for primary as well as secondary settling and for controlled and continuous dosing of filter with the wastes directly as it flows out of the factory. Filtering at a rate of 3 m.g.a.d. it has been possible to remove over 70% of the organic load in the wastes.

16. Prospects of sheet Metal Industries in India.

J. N. BASU, *Calcutta*.

Sheet metal industries in India are still in its infancy in India. During the last war certain impetus was given to this industry and it is expected that advancement already made, should be progressively maintained & continued in post war period as well.

In this article I attempted to incorporate the utility, present position, difficulties and schemes of equipments required for the following sheet metal industries.

- (1) Metal box (container)
- (2) Hurricane lantern.
- (3) Torch lights.
- (4) Metal toys.
- (5) Hinges.
- (6) Stampings for electric motors, transformers & other electric equipments.

Each of these industries has a vast field in India; the articles made therein are extensive used now a days & some of them fortunately are already receiving favourable consideration by the Govt. of India with certain facilities for their advancement.

The fundamental difficulties common to all sheet works in India lie in the following:—

- (1) Steel for the die or tool,
- (2) Die making;
- (3) The presses & other metal working machineries,
- (4) The quality of sheet for stamping.

The special steel that is required for tools or dies, is not made here. During the war Tata attempted to produce a limited quantity of die-steel. But practically we have

to depend on foreign imports for these articles. Often the steel dealers make the position still more complicated and insecure, being not in a position to supply correct specifications of the steel. There have been very often cases of disappointment, when steel that was purchased for making dies was subsequently found quite unsuitable for the purpose, sometimes after wasting money, time and labour over it by making dies out of the steel. Die is an expensive and accurate tool and unless made of properly selected special steel, it will not last long, nor the work will be accurate.

Die-making is a specialised job; it requires accurate workmanship correct to several thousands of an inch; it requires certain special machines and precision machines and measuring instruments. Besides, heat treatment of dies is another specialised job entailing special furnace with delicate instruments and experienced men to handle it. In India we have at present no specialised die making firms, consequently sheet metal workers are forced to start die-section for their works; that is firstly very expensive requiring substantial capital investment and secondly cannot be so efficiently and economically run. It is definitely a big handicap for many sheet metal works requiring simpler dies or small number of dies for their production; so to advance sheet metal works, die-making should be promoted.

Presses and other sheets metal working machineries. The following are very commonly required in sheet metal work:—

- (1) Presses:—(a) Power press, (b) Fly ball press; (c) Hydraulic press.
- (2) Guillotine or shear machine;
- (3) Rolling machines; (4) Bending machines (5) Circle cutting machine;
- (6) Folding machines; (7) Beading machines; (8) Seaming machines;

Power presses are specified by the maximum pressure the press can safely exert when working and are known as 20 ton press or 20 ton capacity press. They are either (a) Open fronted or C—frame or (b) double-sided, having two column on 2 sides of the press. Another important classification of the presses is (1) Single-action; (2) double & (3) triple-action; they widely differ in design, construction & operation.

The pressure for blanking is determined by the equation $P = L \cdot T \cdot S$, where P —Pressure in ton. L —length of cut in inches $= \pi \cdot D$ in case a blank of D inches diameter is punched.

T —thickness of metal in inches and S —shearing stress of metal in tons per square inch. The pressure for stamping is still a matter of experience and no definite equation can be found out as yet.

The presses are sometimes stated to have capacity proportional to (a) Weight of the fly-wheel, or (b) Weight of the press itself or (c) diameter of the crank-pin; but these equations could not be completely relied on.

Selection of the right press is governed by such factors as:—

- (a) the size & type of die required.
- (b) the length of stroke necessary.
- (c) pressure required for doing the work.
- (d) distance above the bottom of the stroke where the pressure first occurs.
- (e) Additional pressure required due to attachments such as are used for drawing work.
- (f) The method of feeding, the direction for feed, the size of sheet blank, or article.

Only single action power presses up to 30 ton are manufactured in India. Double-action or triple-action and of higher capacity presses are imported. Fly-ball presses of

various capacities, hydraulic presses of limited quantities are also made here now-a-days. Beside, the following machines are also manufactured in India since the last world war to some extent:—Gullotine, Rolling, Bending, Circle-cutting, Folding, Beading & seaming which were usually imported from foreign countries before the last war.

The sheet for blank:—ordinary black sheet or bright-finish or P. C. R. C. A. (pickled cold—rolled, close—annealed) as required for hinges, toys, torch etc. and limited quantity of tinned sheets, that are required for food canning and hurricane lantern, are made here in India. The stalloy sheet that is needed for electric motor A. C., transformers and other electric apparatus, are not manufactured here. We have to depend on foreign import for this article. This is a great handicap for the manufacture of these equipments in India; inspite of the fact that the Govt. of India have prevented the import of certain types of motors and transformers, still the industry is not duly promoted.

The qualities of sheet, such as uniformity in thickness, ductility & finish, besides composition are important factors to obtain good and smooth pressings, free from defects.

In conclusion, I state below two schemes containing list of equipments needed for;

- (1) Metal box manufacture
- (2) Hurricane Lanterns

Equipments for Metal box manufacture:—

- (1) Shearing machines:— ..
 - (a) Hand shear, (b) Power shear, (c) Circle cutting.
- (2) Presses:—
 - (a) Ball presses—6 of different sizes (b) Power presses—8 of different capacities.
- (3) Seaming machine:—
 - (a) Circular, (b) Elliptical, (c) Rectangular;
- (4) Folding Machine: (5) Beading machine: (6) Printing equipment: (7) Soldering equipment: (8) Welding set: (9) Electroplating equipments (10) Spray-painting equipments: (11) Stove enamelling arrangements: (12) For die-making:—Lathe, Drill, Milling, Shaping, Planing, Grinding, Do-all, Power-saw, welding.

Item 6, printing equipments to print on sheet is a complicated job and the equipments are also very expensive. We are to depend solely on foreign import for the machine which is very costly as well.

Equipments for Hurricane Lantern factory:—

- (1) Shearing machines.—(a) Hand—2 pcs; (2) Power—2 pcs; (3) Circle cutting—1 one.
- (2) Power presses of different capacities from 10 tons to 40 tons both single action & double action—30 pcs.
- (c) Ball—presses & arbon presses—24 pcs.
- (4) Seaming machine—6 pcs.
- (5) Folding machine—2 pcs.
- (6) Bending machine—2 pcs.
- (7) Soldering equipments.
- (8) Electroplating arrangements.
- (9) Spray-painting equipments. (10) Stove enamelling equipments.

- (11) For die making.—Lathe, Shaping, Milling, Grinding, Drill, Power-saw, Do-all, Welding set.

The complete set of equipments will cost nearly Rs. 200,000/- (two lacs) and can produce about 400,000 lanterns each year. The working cost is calculated to be Rs. 1|4/- per lantern.

17. The Spectro-chemical Analysis of Ferrous Alloys with the Medium Quartz Spectrograph.

K. C. MAZUMDER, Jamshedpur.

A preliminary report is given of the Spectro-chemical determination of the elements Al, W, V, Mo, Ni, Cr, Cu, Mn and Si found in the ferrous alloys by means of the medium spectrograph. This instrument is not considered to be good enough for this work on account of its low dispersion. The calibration curve obtained for the above elements are given. The curves are regular and smooth showing that the instrument can possibly be used for carrying out the ferrous alloys analysis.

18. Calibration of Photographic Plates.

B. N. BHADURI, Jamshedpur.

A series of experiments for purposes of plate calibration is intended to be carried out. The first of the series follows and an account of the method for selecting the appropriate calibration line pairs is given. Analyses of high speed steel by spectrographic methods were carried out in the research laboratories of the Works. Plate calibration from intensity considerations alone, and its application for evaluating alloys in steel were thought desirable. The first object was thus the selection of line pairs.

19. The Spectro-Chemical Analysis of the Bearing Alloys.

M. K. GHOSH, Jamshedpur.

The technique of spectro-chemical analysis of the bearing alloys with copper base has been developed by means of Hilger Medium Quartz Spectrograph. The ranges of the different elements determined are:

Sn 6.50-7.90%

Pb 3.0 -3.65%

Ni 0.70-1.0 %

The determinations agree well with those found chemically.

20. Basic-to-neutral Refractories from Refractory and Non-Refractory Magnesium Silicate Rocks.

H. K. MITRA, Jamshedpur.

Practically neutral refractories have been developed from refractory and non-refractory Magnesium Silicate Rocks. Following the line of investigation, for making refractories from non-refractory Chrome Ore as described in a previous paper the raw materials were calcined to about Orton Cone 31 with the addition of Magnesium Carbonate to form Forsterite and Spinels. To further improve the Slag Resistance of the resultant brick Chrome Spinels were formed by introducing High Grade Chrome Ore at the time of Calcination. The method described makes it possible to utilise a variety of raw materials including non-refractory ones, for the manufacture of refractories with superior physical properties.

21. Petrographic Data on Chrome Magnesite and Magnesium Silicate Refractories.

J. C. BANERJEE, Jamshedpur.

Petrographic properties of Indian Silica and Magnesite bricks have been reported in a previous paper. In the present one Petrographic Data on Chrome Magnesite and Magnesium Silicate Refractories have been given. For comparison European and American Bricks have been included. An attempt has been made to interpret the Refractoriness Underload Values in the light of their Microscopic Characteristic.

22. Coking Properties of Coal.

S. N. SIRCAR, Jamshedpur.

In view of the limited reserves of coking coal in India which is indispensable for the Iron & Steel Industry, measures have been taken to restrict its use for metallurgical purposes and to blend with inferior grade poorly coking coal with a view to prolonging its availability for metallurgical purposes. Even then because of the contemplated industrial expansion in the country the period of this availability cannot be so prolonged as to safeguard the existence of the metallurgical industry in India for long. The only possible means of enlarging the coking coal for the metallurgical industry is to explore the possibility of converting the non-coking coals into coking coals.

These can be done only by intensive research on the coking properties of coal.

Prof. Wheeler, Frank, Fisher, Parr, Hadley and many other research workers have carried out research with a view of studying the fundamental structure of coal by extraction method.

Blayden, Riley and Show made X'ray studies of coking coal for determining agglutinating properties. Work has also been done to produce coke from non-caking coals by various means. Fisher experimented on the carbonisation of coal under a pressure of about 50 atmos and he obtained strong dense coke from non-caking coals of high Oxygen content. L. J. Davis has described the production of coke from powdered anthracite by mixing it with 20% of pitch or 25% of tar. Bergins process of hydrogenation of coal by hydrogen under pressure also improved the non-caking coal of which the caking power was even beyond the range of normal coals.

Besides the academic work mentioned above many attempts have been made for practical use of the processes developed though none has been reported to be of any commercial importance. Some of these processes are: the 'Fuelite' process of England, the 'Carbocoal' process of America, 'Colloidal Briquetting' and 'National Fuel Process' developed by the American Cyanamid Co. of America and lastly the 'Two Step' process of converting non-caking coal into coke as developed in Germany.

In the interest of the metallurgical industry in India coking research should therefore be given the first priority and some of the processes described above or new process developed and made into a commercial success.

23. Planning of Consumption of Coal (Scientific and Rational Use).

A. K. SHAHA, Calcutta.

The principles on which the Planning of Consumption of Coal will be based, may be taken as the following:—

1. The Attainment of complete combustion of coal with minimum excess air wherever coal is used as Fuel. ●
2. The Utilization of all the amount of Heat thus developed for useful purposes, with minimum loss.

3. The complete Recovery of By-products during the process of Carbonization of coal.
4. The use of Proper grades of coal to suitable Industries. If these four Scientific Principles are adopted, the present consumption of coal can be reduced by 20-25 p.c. and in 1956, the production of 32 million tons of coal will serve the need in place of 41 million tons, as proposed by the Coal-Fields Committee, 1946.

A simultaneous campaign on two Fronts Production and Consumption can solve our National Problem. The demand for unscientific and irrational consumption should not be met by increase of Production as this would mean waste of National Wealth.

The scheme is based on present conditions with minimum additions and alterations and without slightest interference with the routine work of the plants. Of course Scientific measures always go parallel with the increase of Production as well as better quality of Products.

The following examples of huge 'misuse' of coal and their remedy explained:—

1. Loss of 30 million gallons of tar in the process of soft coke manufacture is increased every year. The author explains his own method of Low and Medium temp. of carbonization of coal.
 2. While operating coal mines—valuable coking coal and as well as 1st grade coal is used in boilers. Author suggests to use dust coal in the form of Briquettes.
 3. Railways can use Low grade coal dust formed into enriched Briquettes and as well as to provide modern Locomotives with condenser installation.
 4. In boilers, Furnaces and Kilns—to install Recuperators and regenerators.
24. Laboratory Experiments on the Isolation of Ceria from Monazite Sands of Travancore.

V. G. IYER and R. PRASAD, Benares.

With the increasing applications of cerium in varied industries, the process of extracting ceria from Monazite sand of Travancore has to be perfected first. An attempt has been made to that effect in this paper. It has been broadly divided under two heads:

(i) Introduction and (ii) Experimental part.

In the introduction, a brief survey of the deposit of Monazite sands of Travancore has been made with a short historical review on general. Its growing importance has been emphasised owing to its Thorium content which can be used in future as a target atom for the liberation of atomic energy. Apart from its use in the gas mantle industry, it finds application in the manufacture of pyrophoric alloys and various other industries, a fact which has made it still more important.

The experimental part consists of the following:

- (i) Treatment of crude ore monazite sands.
- (ii) Qualitative chemical analysis of monazite sand.
- (iii) Extraction of ceria from Monazite sand.

25. A note on High Frequency Current Density in a Hollow Cylindrical Conductor.

SANTI RAM MUKERJEE, Benares.

Hollow Cylindrical conductors have lately gained very wide application in Radio Engineering. Due to their non-radiating properties, they are conveniently used in connection with ultra-short and micro-wave transmission lines, wave-guides, etc., particularly for Radar and Relevision purposes. It is often found necessary to know the current density along the radius of such a conductor, specially to detect the formation of stationary waves along the cross-section of the tube. The current density for steady sinusoidal current can be calculated by Bessel functions, and in the present communication, the solution has been obtained for varying high frequency current flowing through the conductor. For the purpose of relaxed oscillations, a solution has also been obtained for linear variation of current with time.

26. Some Observations on the Recrystallisation of Silicon Ferrite.

S. VISWANATHAN and R. MUTHUSWAMY, Jamshedpur.

The effect of deformation on recrystallisation of one per cent, silicon ferrite has been studied. Increasing deformation increases the rate of re-crystallisation as a resultant increase in both the rates of nucleation and growth.

The effect of temperature on isothermal recrystallisation curves was studied. Temperature increases both the rates of nucleation and growth.

K. C. MAZUMDER, Jamshedpur.

The Binary alloys of some metals like Cu, Ag and Au can be expressed by approximately definite chemical formula and are known as abnormal valency intermetallic compounds. The different phases of these alloy systems have definite electron-atom ratios which are generally expressed as 1.4, $3/2$, $21/13$ and $7/4$ for the α , β , γ and ϵ phases respectively. They can, however, be expressed more uniformly as $21/15$, $21/14$, $21/13$, and $21/12$. This regularity suggests the possibility of extending the series inside the L- phases. The L-phase may, then, be composed of several minor phases of electron-atom ratios, $21/16$, $21/17$, $21/18$, $21/19$, $21/20$, at the boundaries of which there will be discontinuities, however small, of some physical properties of the alloys. The indications of such discontinuities found in the published data are discussed.

SECTION OF AGRICULTURAL SCIENCES

PRESIDENT: RAI BAHADUR KALIDAS SAWHNEY, M.Sc., F.A.Sc.

1. Effectiveness of Green Manuring in Terms of Crop Production.

P. G. KRISHNA and D. V. G. KRISHNAMURTY, Hyderabad-Deccan.

The green matter ploughed into the soil in the form of Sannhemp and Daincha varied from 6,000 to 23,000 lbs. The total nitrogen added to the soil due to both green matter and fixation in soil varied from 160 to 290 lbs. In spite of these huge amounts of nitrogen derived from green manuring, the net gain, as reflected in the yields of sugarcane, is the same as would be obtained from an application of a mere 50 lbs. of nitrogen in the form of oil cakes.

2. Anthocyanic Purple Pigment in the Sorghum Ovary and its Genetic Relations.

C. VIJAYARAGHAVAN and A. KUNHIKORAN NAMBIAR, Coimbatore.

Anthocyanic plant pigments occur in several parts of the Sorghum plant. A transient type of purple colour was observed in the ovary of a type of *Sorghum caudatum* Stapf received from Africa. The purple pigment occurred in the sub-epidermal layer of the pericarp of the ovary and was confined to one or two layers of cells only. It was intense at the time of flowering, but faded away in a day or two. The pigment was soluble in water and alcohol and turned into greenish yellow by alkali and red by acids. A survey of the existing types of sorghum at the Millet Breeding Station showed that this character was rare especially in the Indian types. In segregations, the purple ovary was dominant to the colourless one. A factor Po produces this purple pigment in the ovary. Po is a monogenic dominant to po. This gene Po is located in the same linkage group in which sheath—dry anther colour, sheath—juiciness of stem, and sheath—grain colour genes are situated.

3. Influence of Panicle shape on the Vegetative Characters in Ragi—*Eleusine coracana* Gaertn.

C. VIJAYARAGHAVAN and U. ACHYUTHA WARIAR, Coimbatore

By grouping the *ragi* population into the phenotypes "top-curved", "in-curved" and "fist-like" and viewing their behaviour critically over a number of seasons, it was observed that the genes E₁ and E₂ acting additively differentiate the three types in finger length. They also exert an influence on certain other characters like height, length of peduncle and flag length. This multiple effect of the genes was confirmed by a detailed study of comparable sister families. The manifestation of this genic influence was noticeable in spite of the climate factors of different seasons and years.

4. Determination of Milk Solids.

K. M. MEHTA, Jodhpur

In the course of examination of milk samples, cow and buffalo, under the Marwar

Pure Food Act it has been noticed that the total solids of milk generally are in excess by the Richmond scale when compared to the direct Gravimetric method. This is more so when milk is adulterated by adding water, abstracting fat or both. In order that uniform results for total solids in milk are obtained from the different laboratories it is desirable that a common standardised method for its determination is prescribed by the Central Committee for Food.

5. The Ferrous Iron Contents of Indian Soils.

U. P. BASU and S. C. CHAUDHURY, Baranagar, Calcutta.

The deficiency of iron intake leads to nutritional and hypochronic anaemias in man with consequent loss of health and economic efficiency. We get our normal requirement of iron from food stuffs, the major part of which is derived from vegetable sources. The iron contents of these food materials of plant origin are again obtained from the soil on which the plants are grown. As such a knowledge of both the total and ferrous iron contents of a soil would be a valuable guide to the level of iron contents of food crops and other vegetable matter grown on it. It is known (Kliman, Soil Sci. Soc. Amer. Proc., 1937, 2, 385) that it is the ferrous iron that is absorbed and utilised by plants.

In this paper total and ferrous iron contents of soils from Bombay, U.P., C.P., Madras, Orissa, Bengal, Bihar, Punjab and Sind have been ascertained, and suggestions have been put forward that the total and ferrous iron contents in various parts of our country and in different seasons be determined. These would be helpful in correlating the relationship between the iron contents of food crops and the health of the human as well as cattle population of the respective areas.

6. An Improved Type of End-Over-End Shaking Machine.

G. S. RAISINGHANI, Halani, (Sind.)

A large number of soils and sub-soils has to be tested for their total salt content in the irrigation Research Laboratory of the Sind Public Works Department. Actual measurement of electrical conductivity takes far less time than the preparation and shaking of soil suspensions. With the available convenient models of shaking machines, ten soil suspensions could be shaken at a time. There has, therefore, been need of a machine which can shake a large number of soil suspensions at a time without being bulky, costly or unwieldy. With this object the improved type of end-over-end shaking machine has been designed. It is a modification of the Wagner's End-over-end Shaker of the Baird Tatlock and Co., Ltd., London and its advantages are:

- (a) The convenient size and the principle of end-over-end shaking of the Wagner's Shaker have been retained;
- (b) The capacity of shaking bottles has been increased from ten to twenty four;
- (c) For the same cost, construction of the improved Shaking Machine is more robust;
- (d) More efficient and easy screw device for fastening bottles in the machine has been provided;
- (e) The improved type of Shaking Machine can carry and shake bottles of any size and shape.

The improved type of Shaking Machine was manufactured in the Kotri Workshop of the Development and Research Division and is now in use in the Irrigation Research Laboratory at Karachi.

The paper is accompanied by a blue print sketch of the improved type of shaking machine.

7. The Influence of Stage of Growth on the Chemical Composition of Some Perennial Grasses.

B. M. PATEL, Anand.

It would be a national economy if fodder crops could be harvested at a stage when they are most nutritive. In order to find out at which stage the three perennial grasses (Napier, Guinea and Elephant) should be harvested this experiment was carried out.

Three above-mentioned grasses were harvested at the following stages:—

I. (1) Preshooting stage, (2) Boot stage, (3) Inflorescence stage, (4) Post blooming stage, (5) Mature stage.

II. Cutting at an interval of 30, 50 and 70 days.

The samples were analysed for their composition which indicates that it is always beneficial to harvest the grasses either at its pre-shooting stage or at 30 days intervals. In the more mature stages the protein, fat and carbohydrate contents are reduced and fibrous portion and silica content portion increased.

8. Structure in Black Cotton Soils of the Nizamsagar Project Area—Hyderabad State.

P. G. KRISHNA and S. PERUMA, Hyderabad—Deccan.

The black soils exhibit a characteristic structure in their subsoil. Details of this structure have been noted in the Raichur District in the year 1931. Later on, a special study has been made from about 1943 in the Nizamsagar Project area.

This structure has been termed 'Lentil' as there is close resemblance to the lentil seed.

The shape, size, and make up of the structural aggregates do not fit them into any of the forms—Cubic or Sphere-like, Columnar or Prismatic, and Platy, which are commonly recognized.

Only the upper surface of the aggregate is convex-shaped, when the structure is faintly developed. Both sides of the aggregate are convex when the structure is well developed. The aggregates are quite lentil shaped, stable, and measure (7" × 4"), (8" × 5"), (9" × 5"). They can be detached with ease from the soil body. In soils with impeded drainage these lentils are hard and break into irregular or prismatic clods. In good pervious soils they are soft and peel off into several similar very small stable lentils measuring one by one-fourth inch.

The lentil aggregates are seen to form parts of larger and huge lentils of similar shape, several feet in length and width fitting in with the depth of this structural horizon.

The structural pattern consists of a set of parallel planes of cleavage inclined about 30° to the ground level. These planes seem to indicate the direction of subsoil drainage.

Soils possessing this characteristic lentil structure are highly productive, highly absorptive and not easily erodible. Also, in them, alkaline patches are few and rare.

9. Barbada and its usefulness as Green Manure Crop.

P. G. KRISHNA, Hyderabad—Deccan.

Barbada (*Indigofera barbara* Gamble), a busy leguminous plant of the Indigofera group is found growing wild all over Hyderabad State. This plant was tested for its usefulness as a green manure plant for three years in pots and one year in the field. In pot culture tests extending over three years the plant was found to fix appreciable amounts of nitrogen. In the third year this plant was tested against Samhemp and

Daincha both for the green matter produced under field conditions and for its nitrogen fixation in the soil. With regard to weight of the green matter (stems and leaves) it was found to be about equal to Daincha and somewhat less than Sannhemp, and the nitrogen added to the soil by ploughing in the whole plant was estimated to be more than that of Daincha but less than Sannhemp, and this was calculated as 60, 55, and 78 lbs. nitrogen per acre for Barbada, Daincha and Sannhemp respectively. By the analysis of soil samples collected before and after cultivation of the crop it is estimated that the nitrogen increase in the soil was about 276, 292 and 256 lbs. per acre for the three crops Barbada, Daincha and Sannhemp respectively. Therefore, Barbada can be said to be quite as suitable as Daincha and Sannhemp for green manuring. Barbada stems are very thin as compared to those of Daincha and Sannhemp and are likely to be decomposed readily in the soil.

Barbada crop is not eaten by cattle, goats and sheep and being a perennial, would be very useful for reclaiming eroded lands and for improving forest soils. Dr. D. V. Shuhart, the American Soil Conservation expert with whom these results were discussed during his recent visit to Hyderabad agreed to its usefulness for green manuring and for soil conservation.

10. Investigation on the Alkalinity and Saltishness in Gur made from Coimbatore Sugarcane Varieties.

P. G. KRISHNA, Hyderabad—Deccan.

Coimbatore sugarcane varieties when cultivated in new areas yield gur high in alkalinity in ash directly depending upon the water soluble salts in the soils and irrigation waters which are absorbed by the plants.

The alkalinity in ash is lower in gur made from ratoon sugarcanes than in gur from plant (new crop) canes. Also a great number of gur samples from ratoon canes is sweet or less saltish than from new crop. This indicates that on continued cane cultivation, the gur produced will tend to be less alkaline and less saltish to taste. In other words, it tends to become sweet.

Sweet gur was always yielded by Coimbatore Sugarcane variety 419, and almost always by 434. On the other hand, Co. 290, 301 and 244 always gave saltish gur. This may be varietal characteristic indicating selective absorption of the salt present in the soil.

There was no correlation between the taste of gur and total alkalinity in its ash. Some gur samples with high alkalinity had a sweet taste while others with very low alkalinity had saltish taste.

Saltishness in gur is due to the presence of chloride in it. If the chlorine content is more than 0.50%, the gur tastes saltish. The sulphate content has no such effect.

For new irrigated areas, it is suggested that a variety of sugarcane like Co. 419 which always yields sweet gur may be grown. In the alternative, prior to the introduction of Coimbatore sugarcane varieties, ryots may be advised to cultivate paddy for at least two seasons before planting cane so that the chances of obtaining saltish gur become minimised.

For reclaiming saline areas Co. 290, a very hardy variety, may be recommended to be cultivated, along with systematic leaching, as this variety not only absorbs large amounts of salts but also withstands water-logging.

11. Studies on Indigenous Methods of Storage of Butter.

K. S. RANGAPPA and B. N. BANERJEE, Bangalore.

Desi butter is stored for a number of days before it is melted into ghee. In some villages it is stored over buttermilk but generally in collecting centres and with retailers

or wholesale dealers it is stored dry in tins. An examination of the two methods showed that after 12 days of storage, the sample in butter-milk of 0.6-0.8% acidity developed six times less (0.56%) acidity than that stored dry (3.4%). Experiments on storage of butter in water and in lactic acid solution (0.8%) showed that while storage in water largely suppressed acidity development, the butter tended to lose flavour. In lactic acid, on the other hand, the flavour also was retained. From the point of view of flavour, low acidity and storage property of butter and ghee, storage in the following order, in lactic acid solution, butter-milk or water is recommended. The liquids should be changed every day. However, butter should not be stored in hot climates at all, but melted into ghee at once as even salted, pasteurised and 'lined' creamery butter (Indian or Australia) do not keep sweet for more than four months (% acidity).

12. Standardization of the Ginning Technique for Small Samples.

R. L. N. IYENGER and D. L. SEN, Matunga (Bombay).

The object of the present investigation is to standardize a technique for ginning small samples of cotton in cotton breeding stations which would give the value of the ginning percentage corresponding to that given by a normal commercial gin. The study was carried out to find the effect on the ginning percentage of three factors, namely, (1) the size of the sample, (2) the method of selecting the sample and (3) the gin used for ginning.

In connection with the first factor different weights of *kapas* were ginned in the same gin but the results did not show any significant influence of the weight of the sample on the value of the ginning percentage.

On the other hand the second factor was found to produce a significant change. A sample made up of whole locks or lumps of *kapas* gave a significantly higher ginning percentage than a sample made up of separated single seeds.

With regard to the third factor tests were made on five kinds of roller gins, *viz.*, (1) locally made wooden gin from Parbhani, (2) Bardoli gin, (3) table model gin, (4) Platts hand gin and (5) Platts power gin of the commercial type. The last three gins were of the Macarthy type while the first two were made of a combination of two rollers. The results obtained showed that on the whole the first two gins *viz.*, Parbhani and Bardoli gins gave a value of the ginning percentage which was about four to five per cent. higher than the values given by the other three gins, the differences among which were only very small. This increase in ginning percentage was found to be due to the crushing of some seeds which were carried over along with the lint. The time taken from ginning a specified quantity of *kapas* was also very much higher in the case of the former two gins as compared with the latter. However, the lint obtained from the former gins was slightly longer and more regular than that obtained from the latter gins.

From the above findings it can be concluded that on account of the higher value of the ginning percentage given by Parbhani and Bardoli gins and on account of the longer time taken to gin in these gins, they are not suitable for standard ginning practice. On the other hand Platts hand gin takes only a small time for ginning and it has the elasticity of managing different sizes of small samples usually met with in cotton breeding as far as possible, all foreign matter that may be present in it. Furthermore it gives the value of ginning percentage which corresponds to that given by the commercial gin and therefore, it can be recommended for general use. For standard ginning practice 25 gm. sample, made up of either whole locks or of lumps of *kapas* appears to be a suitable quantity. It is, however, essential that before the *kapas* is weighed for ginning, it should be thoroughly opened out by hand so as to remove,

13. Compost from Town Wastes, its Composition and Effect on Crops.

K. G. JOSHI and P. S. THAKUR, Nagpur.

The Bangalore technique of composting town refuse not only affords a very sanitary method of disposal of dangerous town wastes but also ensures conservation of manurial ingredients in these wastes and their productive utilization as manure.

2. In comparison with good samples of Farm Yard manure, town composts do not show much superiority on nitrogen basis. They show, however, a very high content of total and available phosphorous, about 2—3 times than that of cattle manure and are superior to the latter in this respect. Compared to the low type of cattle manure, the town composts are very rich. On an average town composts contain 0.8 to 1.0 p.c. Nitrogen and 0.9 to 1.2 p.c. phosphorial Phytosu. The manure of bigger towns (population above 25,000), is generally poorer than smaller towns, the common drawback in the former being the high proportion of stones and scraps in them.

3. On cultivators fields the data collected by us show that the yields of food crops increase by 50 to 100 p.c. over that of unmanured fields. The manure depicts its lumpy nature by showing a residual effect. Certain field experiments also have shown that the manure shows a better performance than the cattle manure but does not compare so favourably with ground nut cake on equal nitrogen basis, as nitrogen of town compost is made available to the plants slowly.

14. Effect of Sunning and Chemical Treatment in Relation to storage of Jute Seeds.

T. GHOSH, B. C. KUNDU and N. BASAK, Dacca.

Corchorus capsularis and *C. olitorius* are two common cultivated species of jute. Both of them suffer from 'Stem-rot' disease caused by a fungal pathogen *Macrophomina Phaseoli* (Mauhl). Stem-rot is primarily a seed-borne disease. The fungus attacks the pod and thereby the ovule and the seed; later the fungus passes into sclerotial stage on and within the seed-coat. It is a common experience that jute seeds cannot be stored in healthy condition for a long period. One of the chief causes in this (1) fungal attack. Other causes are (2) retention of high percentage of moisture on account of improper sunning, (3) premature seed collection and (4) insect attack. Causes (1) and (2) seem to be highly linked. It is seen that after harvest seeds contain as high a moisture percentage as 21.38. Proper sunning at least for 120 hours brings the percentage down to 2.8 on average, which is safe for storage. The best remedy for the primary infection is dry seed treatment with commercial dusts like Agrosan-G or Granosan. Hence, sunning followed by treatment with the said chemicals is recommended before storage. Storage is best under dry air tight conditions. The procedure of storage as recommended involves a very low cost and is within the means of the poorest cultivator.

15. A Comparative Study of the Intra-Class Correlation in Relation to the Efficiency Sampling Techniques on Rice.

P. S. SREENIVASAN and K. DASARADHARAMA RAO, Poona.

The paper discusses the relative efficiency of the two sampling techniques tried on rice at Karjat. The sampling unit that was tried in the year 1937 consisted of four pairs of adjacent bunches separated by three bunches as shown below.

0 0 x x x 0 0 x x x 0 0 x x x 0 0
omit omit omit

In the year 1943 the sampling unit consisted of six bunches three each from two adjacent rows as follows:

$\begin{array}{c} \text{omit} \\ \hline 0 \ x \ x \ x \ 0 \end{array}$	$\begin{array}{c} \text{omit} \\ \hline x \ x \ x \ 0 \end{array}$	$\begin{array}{c} \text{omit} \\ \hline x \ x \end{array}$
$\begin{array}{c} x \ x \ 0 \\ \hline \text{omit} \end{array}$	$\begin{array}{c} x \ x \ x \ 0 \\ \hline \text{omit} \end{array}$	$\begin{array}{c} x \ x \ x \ 0 \\ \hline \text{omit} \end{array}$

Observations were taken on bunches indicated as "O".

The intra-class correlations for the weekly observations on number of culms per bunch and height are worked out. It was found that so far as the number of culms is concerned both the sampling techniques are quite satisfactory, but for estimating the height the modified sampling technique is more suitable. Also there is a strong indication that the seedlings from the nursery at the time of transplantation have highly variable height. But this initial variation in height disappears a month after transplantation.

16. Microclimatic Survey of a Sugarcane Field.

K. M. GADRE, Poona.

The detailed micro-climatic survey of a sugarcane crop has been made at different stages of growth of the crop. This is done with the help of a large number of observers each equipped with an Assmann Psychrometer for recording the variations of the dry and wet bulb temperatures, as well as the vapour pressure and relative humidity at different places in the field. The variations with height as well as the location within the crop are studied. Diagrams showing at a glance the distribution of air temperature and the vapour pressure within the crop have been prepared. These show that the 'Macro' climate changes into the characteristic 'micro' climate of the crop within a few feet as one enters the crop.

As has been shown by Ramdas in a recent paper [Ramdas, L.A., "The Microclimate of Plant Communities", 1946, *The Indian Ecologist*, 1(1) : 1] the sugarcane crop develops an effective canopy towards the end of the season when the crop is 15 to 18 feet high, and when this stage of growth is reached, the microclimate shows the maximum deviation from that of the surrounding open space, and there is a pronounced temperature inversion during day time. This day time inversion has been designated by Ramdas as a 'forced inversion'.

The figures also show clearly how big a sugarcane plot ought to be in order to develop and retain its characteristic microclimate. Further studies are in progress.

17. Study of the Progress of Rainfall and Crops week by week, during the year, in India.

A. K. MALLIK and T. S. GOVINDASWAMY, Poona.

Charts, one for each year, have been prepared in the Agricultural Meteorological Section at Poona, giving a bird's eye view of the sequence of rainfall week by week during each year in each of the 30 rainfall subdivisions of the country for the years 1908 to 1947. These charts show up at a glance, week of excessive or deficient rainfall as well as the dry seasons of the different areas (rainfall less than 0.2" in the week).

Similar charts showing the crop condition week by week in India in symbols and figures have been prepared from the information contained in the crop reports published by the Agricultural Departments of Provinces and Indian States.

The rainfall chart as well as the crop chart for the year 1946-47 are explained and discussed. It has been shown that the destruction of wheat crop in 1946-47 by rust in the central and southern tracts was due to the unseasonable showers received in this area during the winter months of November to February which is normally a dry period for this area. Thus the very poor outturn of wheat in this area could have been foreseen by the end of January. Lack of information regarding the incidence of diseases and their intensity during past years in different parts of the country prevents one from saying definitely whether a more or less similar rainfall distribution in any year is always associated with a poor yield of wheat. The hope is expressed that, in future, the crop reports will become more colourful, containing much more information about the visible effects of weather on crops and their pests and diseases.

18. Studies on the Movement of Soil Moisture and Evaporation.

L. A. RAMDAS and A. K. MALLIK, Poona.

Some investigations undertaken by the Agricultural Meteorology Section at Poona on problems relating to the moisture balance at the surface of the ground are briefly discussed. The mean daily evaporation losses from soil surfaces with the water table at different distances below the evaporating surfaces for the black cotton soil of Poona, the red soil of Bangalore and the sandy soil of Trivandrum are given for 6 months. It has been shown that the rate of evaporation decreases very rapidly as the water table recedes lower and lower from the evaporating soil surface. Evaporation with the water table at 39" below the surface is about 10% of that with the water table at 9" below the surface. A quantitative relationship between the evaporation and the distance between the water table and the evaporating soil surface has been obtained. It has been shown that the mean value of evaporation E_z , when z (in cms.) is the distance between the water table and the evaporating surface, can be obtained from the equation

$$\frac{E_z}{E_0} = 10^{-z^\alpha}$$

where E_0 is a constant for each soil when z is equal to zero. The values of α for the black cotton soil (Poona) the red soil (Bangalore) and the alluvial soil (Punjab) are found to be 0.014, 0.015 and 0.0083 respectively. The method of calculating the mean value of evaporation from as the soil surface with the water table at a known distance below the surface is explained. When the water table is 9" below the surface the evaporation $E_{9''}$ is obtained from the equation

$$E_{9''} = (p_1 - p_2) \times 0.0334 \times V^{1.7}$$

where V = the wind velocity in miles per day,

p_1 = the mean saturation vapour pressure at the mean temperature of the soil (assumed to remain wet always)

and p_2 = the mean vapour pressure of the air at 4 ft. above ground.

Knowing $E_{9''}$ it is possible to estimate E_0 or any value E_z . Such measurements and the values of α that can be computed therefrom are very useful for estimating evaporation losses from large land areas when the depth of the saturated zone and the relation between the evaporation from the small evaporimeter and that from a large area are known.

19. Effect of some Salts on the Capillary Ascent, Permeability, and Swelling and Dispersion of the Black Cotton Soil.

L. A. RAMDAS and A. K. MALLIK, Poona.

The effect of different concentrations of aqueous solutions of lithium carbonate, sodium carbonate, oxalic acid, lithium oxalate and sodium oxalate on the permeability and associated phenomena in the black cotton soil is discussed. It has been shown that traces of these substances increase capillary ascent but there is a rapid decrease in permeability due to the swelling of the colloidal coating of the soil particles with increase of concentration; at still higher concentrations chemical dissolution of the soil colloids restores, to some extent, the permeability. The swelling and dispersion of the soil particles also follow a similar sequence.

The effect of swelling on capillary ascent as controlled by P , the permeability and S , the pore space, at different concentrations of sodium carbonate solution is discussed on the basis of Green and Ampt's equation,

$$\frac{dl}{dt} = -\frac{P}{S} (K-1),$$

where P = the permeability,

where S = the pore space,

K = the capillary force acting on the moving boundary of the water, and L = the height of the wet soil column above the water surface.

It has been further shown that a 5% aqueous solution of sodium chloride restores the permeability of the black cotton soil rendered impervious by sodium carbonate and also moves much faster than water in the naturally occurring "Bari" (alkali) soil of the Punjab.

20. Phenology of the Wheat Crop in India.

L. A. RAMDAS, A. K. MALLIK and O. CHACKO, Poona.

Isocrones for the mean dates of sowing, flowering and harvesting and the duration of the wheat crop in India are discussed in the light of temperature conditions. Charts showing the frequency of night temperatures in India during the winter season are given. The mean dates of sowing, flowering and harvesting of the wheat crop, obtained from the crop-weather calendars, together with details of the temperature conditions during flowering, in the various districts of India are also given in a tabular form.

It has been shown that the wheat crop can be successfully grown only in areas where the winter temperature falls below 55° F. Further the dates of sowing are controlled by the intensity and the duration of the winter season. It has also been shown that date of flowering is independent of the date of sowing so that once the crop is sown, its development (viz., the vegetative and productive phases) is entirely controlled by climatic factors. Over the wheat zone as a whole at flowering time the air temperature varies from about 77° F during day to about 51° F during night with a mean day temperature of 64° F and a diurnal range of about 26° F. Depending upon these conditions flowering occurs later and later in the season as one moves from south to north; the delay in flowering date being of the order of 4 days for every degree variation in latitude Northwards. The duration of the growing season has also been shown to be shortest in the south where the winter season is also shortest and increases northwards as does the length of the winter.

21. An Aspect of Field Study in Soil Survey of India.

R. V. TAMHANE, New Delhi.

Owing to the varying conditions in the different parts of the country the details in soil survey will always be influenced by the nature of the local problems and the purpose of undertaking. Thus there arises the necessity of correlating the soils in one area with those of other areas so as to get a detailed soil map of India on a common basis of classification. The methods of field study used in soil survey projects at Indian Agricultural Research Institute under the guidance of Dr. J. N. Mukherjee include the following observations:

Three types of surveys (1) and the reconnaissance survey (2) the detailed-reconnaissance and (3) detailed survey are generally undertaken. The field technique and measurements as a rule include (1) Base map, prepared mostly on a scale of 4" to 1 mile for a smaller area. In all the cases the area to be surveyed is taken from the Trangulation Scheme established by the survey of India (2) Topography as expressed by contour lines of 25 or 50 feet Topography interval are generally prepared on the base map and in the field smaller intervals of 5, 10 or 25 feet are obtained by actually levelling the area of project. (3) Natural vegetation and their identification should be noted. (4) Notes on Erosion conditions, and present land use, and (5) Profile examination and collection of soil samples. This type of field study helps to form a tentative soil map on which laboratory analysis and determination help to make accurate mapping.

22. Biology, Life-History and Control of *Bagrada cruciferarum* Kirk.(= *picta* Fabr.): Pentatomidae (Rhynchotha)

C. K. SAMUEL, New Delhi.

Bagrada cruciferarum (or the 'painted bug') is a very widely distributed species not only throughout India but also in some parts of Burma and Ceylon. In India, it has been reported from several places as causing damage to a variety of cruciferous crops, e.g., mustard, cabbage, cauliflower, knol-khol, turnip, radish, etc. In Delhi its first appearance on brassica was noticed in the plots of the Botanical Division in December 1939, and since then the pest has been appearing year after year, sometimes becoming serious. In September 1943 the pest caused serious wilting and eventually death of numerous seedlings of young brassica crop by puncturing the central growing points and tender foliage. Adult bugs usually appear on young brassica crop about the middle of September and continue to infest the crop till its harvest in April-May. When brassica is harvested, the adults migrate to alternate host-plants, viz., *Gynandropsis pentaphylla* and *Bollanitia viscosa* (Capparidaceae) whereon they feed and breed from June to August, and when brassicas are sown in September, the pest once again returns to infest the young seedlings. The pest was also observed in small numbers feeding on wheat, maize, lucerne, berseem, cowpea, *Withania Somnifera* and *Heliotropium. Ovalifolium*.

The life-history and different stages of the pest are described in detail.

Control measures tried against the *Bagrada* pest included spraying kerosine oil emulsion—nicotine compound, fish oil rosin soap (2%, 2.5% and 3%) and dusting of DDT and 666 (5%). The mortality obtained in the case of first two insecticides was 90% and 50-85% respectively. Dusting was practically ineffective. When the pest was concentrated on the field bunds, hand-picking and flame-throwing were tried and the pest was well under control.

23. Studies on the Larval Habits of the Sugarcane top Borer, *Scirpophaga nivella* F.

T. V. VENKATRAMAN, New Delhi.

There is no published record of a complete account of the habits of early stage larva of *Scirpophaga nivella* and the exact path taken by the newly hatched larva to reach the growing point of the plant. In this paper this important aspect of the early biology of the top borer is given in great detail. The just hatched larva bites out a hole on the lower epidermis of the uppermost exposed midrib, tunnels through the soft parenchymatous tissue and when it reaches that portion of the midrib which is in contact with the central leaf roll, it tunnels at right angles to the upper epidermis and enters the leaf spindle. If the newly hatched larva cannot get into a midrib it dies for want of protection and food, which at this stage is the soft parenchymatous tissue of midrib.

Some varieties of sugarcane are more resistant to the top borer than others. The morphological characters of the sugarcane plant that appear to be of importance in the relationship between the pest and the host plant are: (1) The amount of lignified tissue concentrated on the lower side of the midrib varies with different varieties. (2) If the just hatched larva cannot bite out a hole in the midrib within a certain period from the time hatching due to the hardness of the lignified tissue, it dies. (3) Comparative midrib hardness is one of the factors which affords resistance to the sugarcane top borer.

24. Preliminary observations on the control of the potato tuber moth *Gnorimoschema Operculella*, Zell. (Lepidoptera: Gelechnidae) by its Natural Parasitic Brason (Microbracon) *Gelechiæ* Ashin, (Hymenoptera: Braconidae) (Hymenoptera: Braconidae).

E. S. NARAYANAN, New Delhi.

The potato tuber moth, *Gnorimoschema operculella* Zell., is a serious pest of potato in storage. The moth lays eggs in the eyes of the tuber, and the larve that hatches out tunnels into tubers and render them unsuitable for human consumption. The storage of this valuable food stuff in or near the centres of production for varying periods is almost unavoidable and it is in the national interest that the damage caused by the tuber moth larvae should be reduced to the minimum.

Bracon (*Microbracon*) *gelechiæ* Ashmead is one of the well known natural enemies of the tuber moth larvae in U.S.A. and Canada, where the depredations caused by the tuber moth larvae is kept under fairly effective check by this parasite. This exotic parasite was imported from Canada in 1944 and in the Entomological Laboratories of the Indian Agricultural Research Institute, the parasite is bred in thousands. The results of the preliminary experiments indicate that the parasite can to a great extent reduce the pest population. With the same initial infestation it was found that the emergence of the moths from the control trays was five to seven times more than from the experimental trays in which the parasites had been liberated.

25. Preliminary Studies on a Chemical and Physico-Chemical Control of the Leaf-Curl Disease of Tobacco.

B. RAMA MOORTHY, S. V. DESAI and C. K. SAMUEL, New Delhi.

The leaf-curl disease of tobacco is known to be a virus disease transmitted by the white fly *Bemisia tabaci* (Gen.). The physical and nutrient conditions in the soil are generally known to be important for the development of certain diseases caused by fungi and have lead to the starting, among mycologist a school of "Predispositionalists" and another school opposing this. There is therefore a great need for experimental

evidence on the influence of plant nutrition on infectious diseases like the leaf-curl diseases.

In the course of experiments carried over three years, manurial treatments were found to have a great influence on the resistance to the leaf-curl disease of tobacco. Three kinds of observations were made. (1) Out of the differently manured plants, those treated with N carried maximum of disease while those treated with P carried no disease. Treatment P+N was intermediate. This result was the same either when the plants were left to the natural conditions of disease infection or when they were artificially infected with disease carrying white flies. (2) The P:N ratio of the healthy leaves was higher than that of the corresponding diseased counterparts. (3) The disease symptoms could be arrested even in the susceptible farm yard manure treated plants even after the onset of the disease by secondary additions of superphosphate at a later stage. The corroborative inference from these three types of observation was that additions of nitrogenous manures increased the susceptibility while those of P increased the resistance to the leaf-curl disease. Some of the predisposition to disease as a result of heavy nitrogenous manure could be reduced by the application of B, Cu, Mn and Zn. But definitely better results could be obtained by the addition of super instead of these minor elements.

Differently coloured mulches also showed varying degrees of resistance to disease indicating the influence of soil temperatures in controlling the susceptibility to leaf-curl disease.

It is proposed to continue the experiments to confirm the interesting results so far obtained.

26. Some Biochemical Studies on Nitrogen in Soil and Manures.

S. V. DESAI and B. V. SUBBIAH, New Delhi.

As the principal biological processes in the soil are those of hydrolysis and oxidation, the solvent action of 80% sulphuric acid has been suggested by several workers for characterising the soil organic matter and for differentiating relatively easily decomposable material and material resistant to bacterial activity.

From the point of both nitrogen and carbon, hydrolyzable by 80% sulphuric acid, the manures studied were found to be of the following order:—Farm yard manure, compost, cowpeas, mustard cake and activated sludge. Both the total C:N ratio as well as hydrolyzable carbon to hydrolyzable nitrogen tallied except in the case of last two in which the order was reversed.

The relative nitrifiability of these organic manures as determined in the laboratory incubation experiments was found to be in the descending order of (1) Mustard Cake (2) Activated sludge, (3) Green manure, (4) Compost and (5) Farm yard manure. Addition of inorganic nitrogen invariably increased the amount of nitrogen nitrified. The nitrification values were found to depend more on the sulphuric hydrolyzable carbon and sulphuric hydrolyzable nitrogen ratio than on total C and total N.

The straight line graph obtained by plotting the nitrate formed with ratio of hydrolyzable nitrogen to the carbon oxidised during incubation showed that nitrate formation was dependent upon hydrolyzable nitrogen.

Further the hydrolyzable nitrogen of manures and soils was also found to be correlated with yields and nitrogen recovered by the crop in the field experiments at Delhi.

These results suggest that the mineralization of nitrogen depended on the 80% sulphuric acid hydrolyzable nitrogen and that determination of this fraction is useful in judging the nitrogen availability to the crop.

27. A Preliminary Study of a Few Sampling Sizes for the Growth Observation of Field Cotton.

P. S. SREENIVASAN and T. S. GOVINDASWAMY, Poona.

Three sample sizes namely 8, 16 and 24 foot-rows made up of two parallel 4, 8 and 12 foot length in two adjacent rows respectively were tried for making quantitative growth observations on field cotton. It was found that there is no appreciable gain by adopting bigger sample sizes for observing the mean number of plants per unit length, mean height of plant, number of monopodial and sympodial branches. But in the case of mean number of flowers per unit length, there is an appreciable decrease in the coefficient of variation when the sample size is increased.

28. A Statistical study of the growth of Sugarcane at Poona.

V. K. RAMABHADRAN, K. S. KRISHNAMURTHY and P. S. NAYAR. Poona.

In this paper growth curves are fitted to germination counts, height of cane and the brix reading. It is found that germination and 'brix' follow the law

$$\frac{dy}{dx} = a(k - y)$$

where a and k are constants. The height, however, follows a more general curve, viz.,

$$\frac{dy}{dx} = f(x)y(k - y)$$

where $f(x)$ is a function of time (x) and k is a constant.

Each growth phase of the sugarcane crop is thus conveniently represented by a set of "growth constant". Such a process summarises the entire life history (from sowing to harvest) of the crop. These constants as well as those representing the variations in the climatic factors vary from year to year and can be correlated with the variations in yield.

29. Intraclass Correlation and Sampling Efficiency.

V. K. RAMABHADRAN, K. DASARADHA RAMARAO and J. G. GRIFFITHS, Poona.

The paper discusses the efficiency of the 8' linear sampling technique for sugarcane by calculating intraclass correlations for the weekly observations of height. It is found that such a sampling is suitable for the sugarcane crop.

30. A note on the Biology *Pocillonola plagiola* Hmps. (Arctiadae).

B. B. BOSE, New Delhi.

The food plant of the caterpillar of this moth which belongs to the family Arctiadae was discovered in 1943 at Delhi although the moth was described as far back as 1808. The caterpillars feed under natural conditions on the leaves of *Eriobotrya japonica* Lindl. (loquat) which is a luscious Chinese fruit and is grown all over India but much more successfully in the North West of India and the fruits are available in the market for sale during summer and upto October in Delhi.

A coloured plate has been prepared showing the caterpillar, pupa, cocoons and a female moth. The pupal period in captivity was 17—10 days in February-March 1943, and the caterpillar is characteristic as it has only 3 pairs of prolegs on the 4, 5, 6 abdominal segments and carries a chain of head moults over its head almost vertically. The larva, pupa and cocoons have been described.

31. Virus Diseases of Sann-Hemp (*Crotalaria Juncea* Linn.) in India S. P. RAYCHAUDHURI, New Delhi.

Three virus diseases have been observed on sann-hemp (*Crotalaria juncea* Linn.) so far in India; these are Mosaic, Smalling and Leaf-curl.

Symptoms of the three diseases are described in detail. In the case of mosaic, characteristic mottling is the chief symptom while in smalling and leaf-curl sterility and development of enations respectively are the distinguishing features. Mosaic and smalling are transmissible by sap-inoculation while leaf-curl is not sap-inoculable, although it can be successfully transmitted by grafting. Host-range of all the three viruses has been studied.

The mosaic virus has a thermal death point of 68°—70°C., longevity *in vitro* of 71-76 days and can tolerate a dilution of between 1: 1,000—1: 5,000 while the smalling virus has a thermal death point of 85°—90°C., longevity *in vitro* of 41—50 days and can tolerate a dilution of 1: 25,000—1: 30,000. No evidence of seed transmission has been observed in the mosaic and leaf-curl diseases.

32. Climatic Factors Responsible for the outbreak of Agrotis Pests. A. C. SEN, Sabour (Bihar).

Very little information is available on the ecological aspects of *Agrotis ypsilon* Rott. which is the most serious pest on the 'Rabi' crops such as wheat, gram and pulses etc., in the low lying areas in Bihar. The first report of the pest in Bihar, is usually noted either in the last week of September, or in the first week of October—depending upon the 'Hathia' (October) rainfall. It has been observed that if this Hathia rain be of intermittent duration or lesser, there is then every possibility of epidemic of this pest. Two reasons can be ascribed to this, viz., (i) weeds thrive well under less flooding conditions and serve as food-plants to the pest, whereas, under heavy rain conditions the low lands remain submerged under water for a longer period and as such, are not fit enough for ovoposition by the pest, nor the weeds are grown earlier to give the ready available food plants. (ii) Soil cracks form an ideal site for the moths to hide and to lay eggs; under heavy flood conditions this crack formations are much delayed.

Early 'Hathia' rain and consequently early receding of the flood water, on the other hand, has been found to be very suitable for ovoposition by the pests. Monsoon rain has no effect on the prevalence of this pest.

33. Role of the Entomology in the Grow More Food Campaign.

A. C. SEN, Sabour, (Bihar).

The incidences of pest infestations are as much dependent on the ecological conditions as on the availability of food plants. Hence, in all our attempts on the intensification of the Grow More Food Campaign, the correlation of the insect fauna with the plant flora should receive first priority and be never overlooked. Grow More Food Campaign should not give rise to Get More Pest Populations.

The disturbances of the crop-rotations and excessive cropping are very likely to give rise to overlapping of the life cycles of certain pests without any break. Unless suitable types of soil and host plants are selected, it would very likely increase the termites and caterpillars in the fields. When requisite chemicals are not easily available, nor are within the purchasing limits of the cultivators, we should give more attention to prevent the occurrence of the pests by inexpensive cultural operations, rather than to resort to chemical warfare in the control of the pests.

A few examples were cited as how in altering the date of sowing, depending on the 'Hathia' rain, the damages from the notorious *rabi* crop pest *Agrotis Ypsilon* Rott. can be greatly averted, how the early paddy, the 'Colaba' variety, can be grown advantageously on a large scale in certain tracts where *Leptocorisa varicornis* F. is rare, how harvesting the potatoes by the middle of February saves the vegetable to a great extent from the *Gnorimoschema operculella* Zell.—all these have been proved by large scale field trials in Bihar.

34. Effect of different forms of Phosphate and their combinations with other manures on Berseem and after-effect on Maize.

S. SEN, New Delhi.

Experiments were carried out at the I.A.R.I. Farm, New Delhi to test the effect of superphosphate, bonemeal, basic slag and ammonium phosphate singly and in combinations with farm-yard-manure, green manure and sulphate of potash on the yield of berseem green fodder and after effects on the succeeding crop of maize. The results of these experiments suggest that ammonium phosphate has better effect on the yield of berseem and in building up the soil fertility, as reflected by the following maize yields, than other forms of phosphate. The best yields were obtained with phosphates in combination with potash or farm-yard-manure. Bonemeal indicated negative effect. Further, basic slag showed a definite manurial value, comparable to superphosphate, on both the crops.



SECTION OF PSYCHOLOGY AND EDUCATIONAL SCIENCE

PRESIDENT: DR. ZAKIR HUSAIN, M.A., Ph.D.

1. Psychological foundations of communal conflict.

P. S. NAIDU, Allahabad.

The present communal conflict has its roots deep in the irreconcilable antagonism between Hindu and Muslim cultures. Culture should be analysed psychologically, and the only school of psychology competent to undertake the task is the Hormo-Analytic school. Hormic psychology analyses culture in terms of the origin and evolution of mental structure of individuals, as well as of races or nations or groups. The inherited elements of mental structure and their development as a result of their contact with the environment, human and sub-human, are sketched here on the basis of Hormic psychology. Account is also taken of the Unconscious in shaping the course of mental evolution, and in the formation of culture patterns. In all this process, it is shown that the MASTER SENTIMENT AS DEFINED BY McDUGALL plays the dominant role. The master-sentiments of Hindus and Muslims are shown to be completely antagonistic. There is no possibility of psychological reconciliation. An honest recognition of fundamental differences is shown to be the only way for communal peace.

2. Koh's Block Design test.

P. S. NAIDU, Allahabad

1. Introduction—A critical estimate of the claims of Koh's test to serve as a test of 'g' factor
2. A survey of recent attempts made in U.P. to adapt Koh's test to local conditions.
3. Formulation of our problem, confined to 11 plus
4. Details of adaptation of the full battery (as used by Koh), and of the abridged battery (as used by Collins & Drever)
5. Validating check-up by correlation with Allahabad Group Verval test for 11 plus.
6. Results and Discussion.
7. Final conclusions.

3. Projection tests of personality.

P. S. NAIDU, Allahabad.

1. Historical Survey of the foundations of Projection methods.
2. Role of Psychoanalysis and Gestalt theorie in determining test methods.
3. Techniques of the newer child-analysis and their influence on personality assessment.
4. The Thematic Apperception Test—a critique.
5. The Rorschach Technique—a critical estimate.

6. A consideration of the concept of personality assumed in these techniques
 7. Suggestions for a new type of Projection technique combining TAT with the story method.
 8. Discussion and conclusions.
4. Discriminating capacity of items of a Word Association Test List.

S. K. MITRA, Patna.

As part of research on the technique of Personality Testing at the Institute of Psychological Research & Service, Patna, analysis of response of different items of the Word Association Test used was undertaken. An attempt has been made in this paper to differentiate items on the basis of their eliciting significant personality pointers. Some items have greater power to reflect individual differences than other items. Certain theoretical observations follow.

5. Language Development in the Child of Two.

G. C. MATHUR, Patna.

A record of speech development of a child was maintained for about a year from the age of one. An attempt has been made to relate the speech peculiarities and increasing vocabulary with the environment of the child as far as possible. Some emotional characteristics of the child have also been noted.

6. Motivation for college courses.

S. C. SRIVASTAVA, Patna.

The purpose of the enquiry reported in the paper is to determine on the basis of a specially prepared questionnaire the tendencies of preference for special subjects of study in College Courses and the motives for the same. The present report covers 80 cases of College students. Certain practical remarks suggested by the findings of the enquiry are also made.

G. KAPAT and C. C. BHATTACHARYYA, Calcutta.

7. Some observations on Passalong Test.

The present paper is based on Passalong Test Results of about 750 boys and girls of varying ages ranging from 9 to 25 years. It presents tentative age norms and also attempts to show the correlation between Concrete Intelligence as measured by the Test and Abstract Intelligence as measured by Terman's Tests. The question whether Passalong Test Scores can be expressed as I. Q. has been discussed.

8. Freud's psychology of philosophy.

P. N. BHATTACHARYYA, Calcutta.

The paper aims at unfolding and criticising Freud's psycho-analysis of philosophy. His reduction of philosophy to psychosis is based on misunderstanding. This Freud could have averted if he had subjected philosophers to analysis and then arrived at generalisations, instead of relying upon second-hand materials.

9. Localisation of 'One-Point' Sensation produced by Double-Point Stimulation.

S. WARRIOR, Patna.

The paper presents a comparative study of accuracy in localisation of sensation of a single touch stimulus and of 'one-point' sensation in the same area of the skin due to stimulation by Aesthesiometric needles. Phenomenological differences are also noted.

10. Study of Industrial accidents in a Textile Mill.

K. C. MUKHERJI, Patna.

This paper is based on an investigation on incidence and factors of accidents among factory workers in the New China (Textile) Mill, Seuri, Bombay. Certain remedial steps are suggested.

11. A study of Correlations on Performance Tests.

G. KAPAT, Calcutta.

Results of four Performance Tests *e.g.*, Pass-along, Dearborn Formboard, Koh's Block Design, Cube Construction, are reported. The paper presents inter-correlations of the different Tests as well as correlation between Concrete intelligence as measured by the Tests and Abstract Intelligence. The questions of validity and reliability also have been discussed.

12. The Psychological factor behind recent Labour unrest in India.

BEPIN BEHARY, Patna.

- (1) Upward trend in the graph of Labour strikes in recent years.
- (2) The Economist's explanation in term of rise in cost of living not sufficient.
- (3) Importance of the psychological factor of increasing frustration feelings needs emphasis.
- (4) Labour unrest and recent communal strife seem to arise from the same background of frustration feelings among the masses.

13. Criteria of interpretation in Personality Testing.

H. P. MAITI, Patna.

1. Fundamental importance of determination of personality pointers in any Guidance or Selection programme.
2. Though interpretation is essentially an art, depending on the practice, training and mental equipment of the interpreter, theoretical analysis of the criteria and methods of interpretation would be necessary.
3. The current assumption that the psychiatrist is specially fitted for the interpretive art is examined.
4. Certain conditions and principles of valid interpretation enunciated and explained.

(Reference has been made in the paper to Tests and Test procedures used at the Institute of Psychological Research and Service, Patna).

14. Estimation of a man's probable success in a vocation.

G. PAL, Calcutta.

Four tests (namely Z_1, Z_2, Z_3, Z_4) were given to 50 Mechanical Engineering apprentices. Proficiencies of these 50 men in Mechanical ability (say Z_0) were assessed and ranked by their Superior Officers.

Correlations of these ranks with each of the four test scores, as well as the inter-correlations of the test scores were calculated. The Values of the coefficients a, b, c, d of the regression equation $Z_0 = aZ_1 + bZ_2 + cZ_3 + dZ_4$ were determined by the Aitken's method. In the present case the equation becomes $Z_0 = .479Z_1 + .150Z_2 + .267Z_3 + .108Z_4$ where Z_1, Z_2 , & C represent the standardised Scores.

To predict the success of a man in the Vocation of Mechanical Engineering Z_0 —the person is examined in the four tests. The standardised scores are then substituted in the equation and the predicted score in Z_0 is obtained.

15. Analysis of a set of tests into independent factors.

G. PAL, Calcutta.

5 tests were applied to 100 College Students. Values of intercorrelations of test scores were calculated.

Hierarchial relations of spearman were not found to be satisfied.

Thurston's method of analysis was applied. Loadings of each of the independent factors as well as those of the specifics were calculated.

Interpretations of these factors in Psychological terms were suggested in the paper.

16. Factors in Number Choice.

RAM MURTI LOOMBA, Lucknow.

A study of the conscious factors in number choice revealed by introspective reports obtained from University students with the help of a questionnaire devised for the purpose.

17. Individual Differences in Imagery.

T. K. N. MENON and S. C. PARIKH, Baroda.

Studies made on the above subject are not many; the importance of imagery in thinking, learning, aesthetic appreciation etc., demand more research on the question. The present inquiry was aimed at to find out among other things whether individuals are capable of evoking all or only particular kinds of imagery and whether the classification of individuals into visiles, audiles, tactiles etc., has any justification.

The subjects chosen were 54 graduate teachers undergoing professional training in the Baroda Training College. The subjects were asked to form voluntary images of 50 items, 5 belonging to each of 10 types. They were asked to mark the images in terms of vividness (Grade of vividness:—Very vivid: 6; Vivid: 5; Clear: 4; Moderately clear: 3; Vague: 2; Very vague: 1; No image: 0).

The analysis of the data made on a group and individual basis and its graphical representation resulted in the following conclusions:—

- (1) Individuals differ very much regarding the vividness of images of different types they form.

- (2) Visual images rank highest in respect of vividness with auditory and tactual ranking next.
- (3) There is no evidence to prove that a person is not capable of forming all kinds of images.
- (4) Particular individuals show difficulty in forming even moderately clear images belonging to some types.

18. Performance of the Arts and Science Graduates at Professional Examinations.

L. J. BHATT and S. C. PARIKH, Baroda.

There are divergent views regarding the relation of 'the knowledge of theory with "efficiency in teaching."' Some people believe that a fairly satisfactory knowledge of theory accompanied by plenty of practice will lead to efficient teaching while others opine that plenty of theory work with some practice will enable to be a good teacher. A reference to the recent change made by the Bombay University re: weightage to theory and practice in the B. T. syllabus may be made. Until recently equal weightage was given to theory as well as practice at the B. T. Examination. Since 1944 more weightage is given to theory and less to practice.

'Does the knowledge of theory help a teacher to better skill in teaching?' With a view to answering this question, the achievement of teachers in terms of marks at Bombay University B. T. degree examination is analysed in this paper. Two batches of Arts and Science Graduates who were admitted to training in Baroda Training College in the years 1944-45, 1945-46 are selected for study. The data consists of (1) Qualifications, (2) Marks in Part I and Part II of the B. T. degree examination—i.e., achievement in theoretical and professional parts of training. The Rank Difference Coefficient of Correlation point to the following conclusions:—

(1) There is justification to assume that a sound knowledge of the theory of Education brings with it skill in teaching practice;

(2) The relation between the knowledge of theory and skill in practice is higher in the case of Arts Graduates than with Science Graduates.

19. Passalong Test.

D. GANGULY, Calcutta.

This test forms a part of the battery of tests that are being used in connection with the vocational guidance work of the Applied Psychology Section of the Calcutta University.

While using the test, the following points were observed:

(1) In this test as in all other types of performance test chance plays some part in the solution of problems with those persons who attack them with no plan. The probability of such chance solution is considerable in the case of sub-test no. 8 of the passalong test because of the local positions of the wooden blocks. It has been observed that some persons are in the habit of manipulating objects with one particular hand and in one particular direction. If the smaller blocks in sub-test no. 8 be placed on the right hand side of the subject and if the testee works in a clock-wise right-handed manner the chances of success become much greater than when the smaller blocks are placed on his left. The subject in action in previous sub-tests should therefore be carefully observed and his habit detected so that the blocks for sub-test no.8 may be presented before him set in such a way as to obviate the chance factor.

(2) If we pursue the figures of sub-tests nos. 7, 8 & 9 of the passalong test we shall see that each one of them is composed of same type and number of blocks only differing from one another in their arrangement. Only one more arrangement is possible which has been left out of consideration in the standard test. The figure of this new arrangement may be taken as sub-test no. 10; it falls in line with the progressive difficulty of the sub-tests. Its inclusion will make the whole test scores more smooth and comprehensive.

20. Mind in the Scale of Evolution.

(A study in Indian Psychology)

K. C. MUKHERJI, Calcutta.

Biological evolution implies differentiation. This is also true of the Samkhya concept of evolution. But there is fundamental contrast in the order of evolution between the concepts. So the position of mind becomes anomalous even though both the concepts maintain purpose in the order of evolution.

21. Is 'G' an Act of Will?

K. C. MUKHERJI, Calcutta

It has been observed that success in Intelligence Tests depends greatly on concentration which dispels distraction caused by other factors. The high correlation of results of the Terman Tests and Passalong Tests suggest close affinity between 'G' and high attentive consciousness which is involved in the performance of Passalong Tests.

22. Measurement of Love-Urges.

J. C. DAS GUPTA, Calcutta.

love urges of 104 persons of which 42 are adults of different ages and 52 children, by the help of a questionnaire of 41 items. The questionnaire scores are correlated with ratings of individual love-urges by skilled observers. Validity of questionnaire devised and applied is claimed. The mean scores for children of different ages as well as those for married and un-married adults are given. The Psychological significance of different types of answers is indicated.

23. Mind-Image.

MISS A. SINHA, Patna.

Apart from the logical concept of Mind, individuals differ as regards their ways of imagining it. An investigation was carried out to study these differences by an introspective questionnaire. Certain broad types of mind-imagery are indicated.

24. Mental Age *versus* Grade Placement.

J. M. SEN, Calcutta.

Wherever mental tests have been given in primary or secondary school classes, wide variability in the mental age of pupils has been the condition commonly found. It is not unusual to find in the same class pupils differing in mental age by as much as four years. Nor are the variations in attainment in any phase of school work

usually discovered to be much less. Yet to most school teachers these conditions seem far less disturbing than wide variations in chronological ages. The latter condition results, of course, whenever gifted pupils are allowed to skip grades or backward pupils are required to repeat grades. Whenever ability grouping is feasible, this condition, however, can be largely eliminated. But the fact that many backward pupils are still likely to be found in grades far below where their mental ages would place them, raises the question as to the comparative importance of grade placement and mental age in school attainment. Gifted pupils not infrequently do a poor quality of work in comparison to their capacity. Is it then, superior attainment of the less gifted, and low attainment of the gifted pupils, that accounts for the wide variability in attainment and mental ages in the classes. The paper discusses the problems connected with the above questions.

25. Mental development of premature Children.

K. D. GHOSE, Calcutta.

Criterion of judging prematurity—weight rather age, less than five and half pounds. A study of fifteen premature children undertaken about ten to twelve years ago i.e., between 1935-37 and carried on since then. Their bodily condition at time of birth and a little later. Their physical and mental growth. Catching up full term boys in weight by the fourth or fifth year. Premature girls slightly under weight in comparison with full term girls. Doubts as to mental development. But no difference in mental ability after the fourth or fifth year, the school rating and intelligence testing being equally good. The great advance modern science of pediatrics has made in overcoming the deficiencies of intra-uterine life. Prematures have a curious mental attraction for one another. Cases of famous prematures like Newton, Darwin, Cuvier, Napoleon, Voltaire, Hugo, Lamartine, Renan and others. The prematures studied progressing satisfactorily except one who succumbed to ricket and anæmia in his fifth year. On the whole, provided sufficient care is taken of them early, prematures thrive mentally just as much as full term children and history records outstanding achievements of famous prematures.

26. The place of English in Secondary Education.

K. D. GHOSE, Calcutta.

Elimination of British rule marks a new epoch in our educational annals—the status of English has to be considered on its own merits as distinct from the language of the ruling race.

The position of English as a world language. The claims of English and Russian considered especially. English spoken over a larger number of important countries.

The great advantages of English for this country.

In a selective Secondary System with Basic Education absorbing the bulk of the school-going population, English should be not merely an optional language but a compulsory second language from Class VII or VIII onwards i.e., from the age of twelve or thirteen. Difficulties as to introducing it at the College or University stage.

The attention in the future is to be devoted to mastering this language in a shorter time by simplified systems or better methods of teaching.

27. On Personality-Matching in selection.

P. D. SHUKLA, Simla.

The importance of personality pointers cannot be over emphasized in the modern scientific method of selection. But for correct selection to be made it is very necessary that the pointers not only interpret the personality correctly but also are uniform in their award of grade. How can we test whether this truth is being achieved by a particular selection organization is suggested in this paper in the form of a statistical experiment.

The paper also incorporates the results of such an experiment conducted on a purposive sample of pointers taken from the Employment Selection Bureau records. The matching is done both quantitatively and qualitatively.

28. A future of Neo-Hormism.

A. K. SARKAR, Colombo.

The article is an attempt to consider possible neo-hormic tendencies in psychology. Naidu chooses Mc Dougall as the best exponent of the contemporary hormic tendency in psychology. He suggests that if Mc Dougall sticks to his original theory of the three-fold analysis of the instincts rather than the two-fold analysis of his later books, he will be able to avoid contradiction.

McDougall however, can be brought nearer Freud if he follows the two-fold scheme of the instinctive activities, admitting a natural evolution of mind in terms of Drever and Rivers. The affective and the conative aspects of mental life are biologically relative and mutually convertible. This tendency will further close up the gulf between the normal and abnormal mental life so often stressed by Freud and McDougall. We shall be drawn nearer to the suggestions of the subliminal self of Myers and Tyrrell, interpreting the phenomena of telepathy, foreknowledge, and the expressions of supernormal personalities, as normal, or as expressions of deeper self which was not recognised previously. But we prefer to suggest that the development of the hormic or neo-hormic tendency along all these directions, should be interpreted symbolically as to admit other ways of development without dogmatising in any one direction.

29. Intelligence Test Scores of 400 I.Sc. passed students as compared with their University Examination Results.

S. K. BOSE and S. C. DATTA, Calcutta.

The paper presents a study of correlations between the intelligence test scores of 400 students who were candidates for admission in the Calcutta Medical College in 1947 and the total marks obtained by them at the I.Sc. examination of the Calcutta University. An 'omnibus' type of test was prepared and used as a group test. The candidates were graded on a five-point scale from the plottings of the test scores. The gradings were compared with the University results. Positive correlation was obtained in most cases, but there were several cases of discrepancies in which students with high University marks had low intelligence scores. Scrutiny of the answer sheets of these students revealed interesting features which at least partly explained their failure in intelligence tests.

The results of testing on the whole tend to support the contention that intelligence test

scores are more dependable guide for judging abilities in practical fields than examination results.

30. Language and Society.

S. K. BOSE, Calcutta.

Human beings live in social groups, and certain recurrent typical situations in the life of the various social groups largely mould the language behaviour of these groups. Language is not merely a vehicle of communication, but the warp and woof of social bounds and obligations. Deriving its force and cogency from the social life a common language assumes the command of the driving power of the society.

The present paper supports the above contention by referring to modes of linguistic expressions of typical social groups or communities of our time.

31. Bases of payment in Industries and their effects upon the employee morale.

S. K. BOSE, Calcutta.

The paper discusses the relative advantages and disadvantages of the Time, Speed and Incentive bases of payment in modern industries, with special reference to the likely effects of the different systems of payment on the moral of the workers. A short critical survey of the present-day systems of payment—Halsey plan, Premium plan, Gantt task and bonus system, Bedaux system, etc.—has been given, and a few observations have been made about the workers' point of view on the basis of impression gathered by the writer by interviewing several workers in factories.

32. Regression in teaching profession—A Survey.

T. K. N. MENON and L. J. BHATT, Baroda.

Growth is the chief characteristic of a master teacher; it is limited by the time and circumstances on which a teacher has no control. What factors—social, economic and personal—contribute to *growth* vice versa *regression* in teaching? Can there be ways and means to check this tendency to regression?

With a view to studying the factors which contribute to regression, a form with 30 items was devised and answers were elicited in writing from a batch of 35 teachers who attended a refresher course organized by the Baroda Training College. All had put in a service of ten years and more after training. The answers make following conclusions evident:—

- (1) All teachers were depressed by their financial circumstances, and lack of status told heavily upon their attitude towards profession;
- (2) They were doing heavy work hence their interest in reading and extra-curricular activities was meagre;
- (3) All of them expected some external agency like Department of Education or Pay Commission to help them;
- ((4) Efficiency, thus, should decrease if the job does not reward a person with satisfaction, does not stimulate him toward further growth nor facilitate the attainment of comforts and fulfillments which are basic to decent human living;
- (5) It is desirable to consider both how a person does the job and what the job does to the person who is responsible for conducting the work.

33. Preference Test of School Children for Different Subjects.

MRS. SHANTA DEB, Calcutta.

This paper is an attempt to find out preference of school children regarding different school subjects. Nearly three thousand school children belonging to twenty different Institutions of Bengal have been tested. Three different tests have been given to each child and the results of these three tests have been calculated statistically. The graphs show how the interest for different subjects vary in different age.

Many defects of our present day educational system come to light as well, of which the most outstanding is that the children of different age-groups are put together in the same grade according to their intellectual ability without any consideration of their mental age.

34. A study of the development of the concept of Class-names in Children.

J. RAMACHANDRAN, Madras.

An attempt is made in this paper to study the development of the concept of class-names by means of a 'Class-name Test' in Tamil given to 655 children of grades IV and V from 8 different Schools at Madras. A quantitative analysis of the results revealed among other things: (i) The difficulty of the problem as is evident from the low mean scores. (ii) Superiority of girls over boys especially after 9+. (iii) The close relationship of conceptual development to educational attainments as revealed by the superiority of 8 year olds of grade V over the 12 year olds of grade IV. (iv) Superiority of the mentally-skilled groups over the manually semi-skilled groups as is evident from a study of results based on the occupations of the fathers. A qualitative analysis of the wrong type of answers written by considerable number of pupils revealed the preponderance of 'Definitions by use', 'Descriptions of things', 'Places where things are found', for both boys and girls.

35. A Comparative Study of Thought Process in Schizophrenics and Maniacs.

K. A. SUMITRAN, Madras.

The purpose of this study is to obtain the exact differences that are found in the performance of three psychological tests in Schizophrenics and Maniacs.

Eight patients from the Govt. Mental Hospital, Madras were chosen, four belonging to each group.

The following tests were administered:—

1. Number series Completion Test (2) Absurdities Test and (3) Analogies Test.

The Schizophrenics fared better in Number series Completion Test than in Absurdities Test.

The Maniacs have scored very high or very low in both Number Series Completion Test and Absurdities Test.

All the eight patients have scored their highest in Analogies Test. In this test the Maniacs kept, more or less, a consistent high level of scoring while the Schizophrenics showed wide range in their scores.

An analysis of the mistakes in Absurdities Test revealed the following characteristics of thought deterioration in Schizophrenics and Maniacs.

Schizophrenic thought characteristics in the order of their deterioration:—
(1) Lack of superficial integration of ideas (18 mistakes) (2) Lack of insight after superficial integration of ideas (14 mistakes)

(3) Inability to feel contradictions (3 mistakes) (4) Usage of unconnected ideas because of "concrete thinking" (17 mistakes)

Maniac thought characteristics in the order of their deterioration:—

- (1) Lack of insight after superficial integration of ideas (14 mistakes)
- (2) Lack of superficial integration of ideas (1 mistake)
- (3) Usage of unconnected ideas (5 mistakes).

36. Colour preference of Hindustani Students.

HAKIM IFTIKHAR ALI KHAN, Lucknow.

The present investigation of the colour preferences of Hindustani students makes use of the materials and the technique suggested by Garth. Analysis of data so far obtained (N = approximately 500) shows the order of preference to be: Red, Yellow, Blue, Green, White, Violet, and Orange.

Certain theoretical points are discussed in the light of our findings.

37. Forecasting of Teaching ability.

HAKIM IFTIKHAR ALI KHAN, Lucknow.

The paper reports the success of an inventory consisting of 21 items in judging teaching ability efficiency. The inventory was tried on 64 students of training class of Lucknow University and validated against the ratings of supervisors. The correlation between supervisors' rating and score on inventory was found to be $+ .14 + 0.791$

38. Fatigue and Efficiency in Textile Industries— a Report.

KALI PRASAD and HARI SHANKAR DUBEY, Lucknow.

Last year a scheme was submitted for an enquiry on 'Fatigue & Efficiency in Textile Industries' to the Indian Research Fund Association, Government of India, New Delhi. A small grant was sanctioned for the purpose. The work is being carried on in the Experimental Psychology Laboratory at the Lucknow University.

The object of the enquiry is to measure the fatigue & efficiency of the workers. The work has been started in the first instance in the Swadeshi Mills at Cawnpore. In the course of our investigation we are utilising the records of the working capacity of the workers in the factories. These will be supplemented by the laboratory tests which will consist both of muscular and some mental tests. The following will serve as indices of fatigue:

- (1) The Output Rate
- (2) The Consumption of Power
- (3) The Accident Rate
- (4) The Proportion of Wastage to Output
- (5) The Proportion of Sickness and Ill-health among the Workers

We hope to find out the major disturbing factors that operate upon the workers and make for their inefficiency and ill-health. Recommendations will then be made in regard to the maximum number of working hours and spells, improvements in the working environment and the application of healthy incentives.

39. A note upon the analysis of 331 'personnel officer candidates' test data at the Tata Iron & Steel Company Limited, Jamshedpur.

S. JALOTA, Jamshedpur.

The candidates were put through a selection procedure consisting of general intelligence tests, personality tests and group discussion tests. All of those tests were given and evaluated by Dr. D. L. Sharma and myself, both of whom have had extensive experience of personal selection procedure. The age range of candidates was 21—53.

We found that (i) Age has a high negative correlation with intelligence test-scores. Some conclude that in the selection of older age groups we should consider other factors besides the factor of intelligence test score. (ii) Multiple correlation coefficient of the final grade with the rest of the tests is quite high:

$$R_{1234} = +.759 ; \quad O'1_{234} = .5536$$

This figure compares favourably with the 'g' Saturation loading of the Final Grading (according to Spearman's method) of .759; and the communality of the same (according to Thurstone's method) of .712, (ii) The relative importance of the following factors in the Final Grading was obtained from the *beta* coefficient of the second order: Group discussions score = 50.6%; Verbal Test Score = 38.39%; Personality Score = 11.1%.

Non-Linear correlations were also obtained. Several of them were significant. Other interesting results of the comparison of Linear and Non-Linear Correlation data are also given.

40. Response Psychology and Religion.

SRIMANT LAL DAS, Patna.

The paper deals with the implications of Response Psychology in relation to religion.

'Response Psychology' is the name proposed for a new science to deal with the response (or reaction) of the external world (to man's inner mental state) and the response (or reaction) of the inner world (to man's inner mental state).

The domain of the supernatural in religion must shrink, and certain religious phenomena may be explained by laws of nature which we find true in our every-day life.

A fair portion of the supernatural and miraculous in religion and life is nothing but the response of the external world or the response of the inner world.

Phenomena like intellectual illumination, inspiration, a number of religious revelations, a large number of dreams that play such an important part in religious literature, Conversion, the Inner Voice, etc. are often but instances of response of the inner world. There may be absolutely no mysticism about them.

With his own experiences of 'Sharnagati' and insight in the working of the response law, the author sees nothing supernatural or miraculous in the achievements of Gandhiji.

41. Study of an insane man.

UDAI BHANU, Indore.

Ten insane persons were kept under observation. But the causative factors underlying their abnormal functions were so different that it was not possible to generalize and formulate specific laws governing them. Therefore, one man was selected. This paper is the study of his behaviours for six months.

The abnormality in his reactions was so clear that any man could notice it. There was nothing wrong in his situation. This shows that the real course of the trouble hid in the brain itself.

The following conclusions are drawn:—

- (I) Insanity is an emotional state. It follows the same laws as other positive emotions follow.
- (II) Heat and loss of sleep excite it.
- (III) Walking in the garden, *etc.*, changing the situation did not produce any positive result.
- (IV) There was no appreciable effect found in him by sleep.
- (V) Different capacities are disturbed in different degrees.

42. Social Psychology and Industry.

S. C. SINHA, Calcutta.

The role of industrial psychology. Failure in our country. Change in political situation. Nation Building and national industry. Industrial reference. Increased output necessary. Depends not only on improved machinery but also on labour personnel.

Vocational Selection—not sufficient, Healthy social life of labour personnels essential. Cause of conflicts outside managements. Necessity of psychological research and handling in the social life of labourers. Social organisation centres. Bureau to train, guide and help in practical and effective way. How to conduct them on proper line. What to know.

Social security. Suggestion regarding duties and organisations of social study centres of the labour personnel. Immediate necessity and co-operation between scientists and Government.

SECTION OF GEOLOGY AND GEOGRAPHY

PRESIDENT : P. K. GHOSH, M.Sc., Ph.D., D.Sc., D.I.C., F.N.I.

A. Geology

1. The petrology of 48 flows of Deccan Trap in Eastern Kathiawar and its bearing on the differentiation of basaltic magma.

W. D. WEST, Calcutta.

The 48 flows, which were penetrated by deep borings, can be divided into three groups : (i) flows of porphyritic basalt resembling the normal Deccan Trap type; (ii) flows with phenocrysts of olivine, pyroxene and bytownite-anorthite; and (iii) flows with phenocrysts of olivine and pyroxene, which can be designated oceanite, ankaramite and limburgite. The three types are interbedded, and the appropriate magmas must have been available for extrusion throughout the period of volcanic activity.

In view of the fact that the normal type of Deccan Trap basalt is remarkably uniform in chemical composition (belonging to Kennedy's tholeiitic magma type), it is tempting to regard it as 'parental', and to infer that other rock types associated with it have in some way been derived from it. The purpose of this paper is to describe some of these other types, and to consider how they may have been derived.

A study of the optical characters and chemical composition of the constituent minerals shows that the *olivine* phenocrysts vary in composition from a variety with about 40% or more fayalite in group (i), through a variety with about 20% fayalite in group (ii), to a highly magnesian variety in group (iii). The pyroxene phenocrysts are diopsidic-augite in groups (ii) and (iii), while the groundmass pyroxenes in group (i) are pigeonitic-augite. The *felspar* phenocrysts are labradorite in group (i), and bytownite-anorthite in group (ii). Twelve new complete rock analyses have been made, while the pyroxene and olivine phenocrysts have also been analysed. These data show that the composition of the phenocrysts is closely related to the composition of the rocks in which they occur.

As regards the origin of these rock types, it might be suggested that the ultrabasic types have been derived from the normal Deccan Trap basalt magma by the sinking of the olivine and pyroxene, and perhaps felspar phenocrysts that occur in it. But the fact that the olivines of the ultra-basic types are more magnesian than the olivines of the normal Deccan Trap basalts, the pyroxenes richer in lime and poorer in iron, and the felspars more calcic, suggests that this has not been the immediate mode of origin.

A second possibility is that long prior to the time of the Deccan Trap eruption the original basalt had already undergone differentiation locally by the sinking of early formed crystals, and that the magmas then froze. Later, when remelting took place magmas of varied composition would be available, and the early formed crystals in the ultrabasic portions would be magnesian olivines, diopsidic pyroxenes and calcic plagioclases.

A third possibility is that the parental magma of the Deccan Traps was more basic than the common Deccan Trap basalt, and that the early formed olivines, pyroxenes, and perhaps felspars, of basic composition, had already sunk prior to the extrusion of the Deccan Trap basalts, and that it was only in certain areas on the west side of India that the magma containing the sunken crystals was also extruded. On this hypothesis the parental magma may have had the composition of the 'olivine-basalt' magma type of Kennedy, giving rise on differentiation to the 'tholeiitic' magma type (the normal Deccan Trap basalt) plus the ultrabasic rocks.

The second hypothesis seems likely to be nearest the truth.

2. Petro-Chemistry and petrogenesis of the outliers of Deccan Trap of the Godavari District.

E. VENKAYYA, Waltair (Communicated by C. MAHADEVAN)

The Deccan Traps of Pangidi and Kateru were studied both in the field and in the laboratory. The geological formations mapped include the Tripati sandstones, Infra-trappeans, Deccan Traps with one inter-trappean limestone band, and Tertiary sandstones with the Godavari alluvium. Attention is drawn to the conflicting nature of the evidence advanced by the earlier works on the age of the Infra-trappeans. Two distinct flows have been identified while the presence of a third flow is surmised. The traps consist of basic labradorite, pigeonite, and iron ores with subordinate amounts of glass and are similar in composition to those of the Central Provinces and other plateau basalts. Niggli diagrams of the analyses show a calc-alkaline trend of differentiation. It is deduced that the traps are derived from a peritic magma which explains the high content of iron and titanium and their high super heat and fluidity. The author concludes that this outlier separated by a distance of 250 miles from the nearest present margin of the main traps was a centre of independent eruptivity in the lower trappean period.

3. A note on the Lingadhalli traps from Chikmagalur District, Mysore State.

C. S. PICHAMUTHU, Bangalore.

A large area in the Chikmagalur District to the east of the Bababudan Hills is composed of basic rocks which have been described by earlier workers under various names—such as traps, hornblendic lava, hornblendic schist etc. In papers presented to this section of the Indian Science Congress (1932, 1933) and published in the Quarterly Journal of the Geological, Mining and Metallurgical Society of India (1932, 1935), the spots and patches occurring in these rocks were described in detail by the writer, and the conclusion was arrived at that they were metamorphosed amygdalites, in some of which plagioclase feldspars were developed.

This paper gives the petrographical and chemical characters of these rocks, and the relation they bear to some of the well known traps occurring in India as well as in other parts of the world.

4. Olivine Norite dyke, Coonoor, Nilgiris.

T. N. MUTHUSWAMI, Madras.

The paper gives a full description of the olivine norite dyke—Coonoor-Nilgiris, described by Sir Thomas Holland in the Records, Geological survey of India, Vol. XXX, 1897. The plagioclase is computed to be $Ab_{22}An_{78}$ from the universal stage measurements of the Albite-Carlsbad complex type of twinning. The rhombic pyroxene is identified to be enstatite with mixtures of hypersthene and the inclined extinction noted is determined to be with reference to a pyramidal cleavage.

The monoclinic pyroxene is considered to be a ferro-augite from its 2 V readings and not pigeonite. The mineral shows diopsidic lamellae. The olivine is characterised by a smoky brown colour with excellent reaction borders. The chemical analysis is given. The C.I.P.W. norm, the Niggli values and the Kata norm have been worked out and the rock is referred to the normal gabbro theralite magma type of Niggli.

5. The Charnockites of Kondapalle (Kistna District).

B. R. CHELUVA IYENGAR, Bangalore.

Detailed field and petrographic study of the Charnockite series of Kondapalle reveal the development of all the four, the acid, intermediate, basic and ultrabasic types in Kondapalle. They are, however, best developed at Ibrahimpatnam, three miles due south of Kondapalle. Two types of hypersthene, differing in pleochroism, (i) x=clear pink, y=yellow, z=bottle green and (ii) x=clear pink, y=brown, z=green, have been separated and chemically analysed and the peculiar pleochroism of the second type is found to be due to the low iron content. As regards the origin of the Charnockites of Kondapalle the detailed petrography, the complete chemical analyses of representative rock types and a detailed heavy mineral analysis, point towards an igneous origin, later subjected to plutonic metamorphism.

6. Geology and petrology of Pachipenta Zamindari, Vizagapatam District, Madras.

G. GOPALAKRISHNASASTRI, Waltair. (Communicated by C. MAHADEVAN)

The author carried out a detailed study of the geological formations exposed in the Pachipenta Zamindari in Vizagapatam District. A geological map of the area was prepared and the sequence of the various members of the Khondalite series—the country rocks in the area—was established. An optically positive cordierite has been subjected to chemical analysis and the anomalous positive nature is attributed to the low FeO-content. Three members of the Khondalite series have been chemically studied. The most extensive rock type, the biotite-gneiss, is considered to be the metamorphosed representative of an argillaceous sandstone. The parent rock of the garnetiferous gneiss is concluded to be an argillaceous sediment slightly poor in alumina. A dolomitic sandstone is supposed to have given rise, on metamorphism, to the diopside-quartzite. Evidences have been given to show that the metamorphism that gave rise to the Khondalites is thermal. Chemical analysis of an augite-norite, representing the Charnockites in the area, has been carried out. Based on petrochemical studies, textural features and field relationships, the Charnockites are concluded to be of igneous origin and intrusive into the Khondalites. The occurrences of some associated economic minerals like mica, graphite and crystalline limestone have also been studied.

7. Geology and petrology of the Kailasa Hill-range.

CH. NARASIMHARAO, Waltair. (Communicated by C. MAHADEVAN)

The rock formations of the Kailasa hill-range and environs in the vicinity of Waltair were studied in detail, in the field and in the laboratory. The physiographic features of these are portrayed elaborately. Vast expanses of the country to the north and the south are covered by red loamy soils and blown sands. The metamorphic rocks, viz., the Khondalites which are sillimanite-garnet-graphite-felspar-quartz-gneisses form the country rock. Charnockites, acidic, as well as basic occur as sills, and bear intrusive relationship towards the para-gneisses. Analytical and field data reveal that Khondalites are highly metamorphosed arenaceous sediments with argillaceous, carbonaceous and ferruginous impurities. It is suggested that granites are formed due to feldspathisation and recrystallisation of Khondalites consequent upon the intrusion of Charnockites. Leptynites are supposed to be the products of recrystallisation of Khondalites in the vicinity of Charnockites. Economically the area is not of great importance. Except for building stones and graphite, occurring in a few lenses and pockets in the proximity of pegmatites there are no other valuable mineral deposits.

8. Khondalite-Charnockite association in Palamau District, Bihar.

K. P. RODE, Dalmianagar.

The author while studying the geology of the region immediately to the south and south-east of Daltonganj, came across a number of rock types which show unmistakable affinities with the Khondalite series of the Eastern Ghats. These include graphite schists with or without garnet, sillimanite, cordierite, biotite, and calcitic and dolomitic marbles, calc-silicate rocks, magnetite bodies, quartzites and leptynites.

These are found associated with basic dykes and granodiorites and granites showing variable development of hypersthene. The mineral and textural peculiarities strongly suggest their resemblance to the Charnockite series.

All the above rock types are further traversed by veins and dykes of pegmatites and aplites.

The field relations as well as microscopic studies have shown that Khondalite-Charnockite association is only incidental and that the former has not played any significant part in the formation of the latter as visualized by Ghosh and others, though a few cases have been found where the Khondalitic gneisses have hypersthene as one of their occasional constituents.

9. A note on the Epidiorite Sill of Ramgarh Area, District Naini Tal, U.P.

I. C. PANDE, Benares.

In this paper the discovery of a sill of epidiorite (as per definition of von Gumbel) in the Ramgarh area ($29^{\circ}26' : 79^{\circ}41'$) in the year 1940 and on subsequent mapping

in 1943, 1944, and 1945 of the adjoining areas and the important results of regional metamorphism as revealed by the internal constituents of the sill rock are recorded.

The sill is very well exposed on the road cutting at 18½ miles on the Ramgarh Nathuakhan road, and at the 9th milestone on Bhim Tal-Mukteswar road, near Buransi. The sill is 60—80 ft thick and more than 8 miles long. It runs in a N.N.W.-S.S.E. direction.

The microscopic examination of these rocks shows that there have been extensive mineralogical changes accompanied by structural deformations during uralitisation, saussuritisation, biotitisation and chloritisation.

The rocks that compose the sill are:—

1. augite-clinozoisite-plagioclase-amphibolite (Sp. No. 1/81);
2. chlorite-biotite-clinozoisite-albite-amphibolite (Sp. No. 1/72);
3. calc-biotite-chlorite-epidote-albite-hornblende-schistose-gneiss (Sp. No. 1/34 & T/100);
4. biotite-chlorite-albite-clinozoisite-schistose-gneiss (Sp. No. M/18);
5. biotite-chlorite-clinozoisite-hornblende-schist (Sp. No. 1/85 & T/101);
6. quartz-diorite (Sp. No. 1/71) which is found at the contact of the sill with the quartz-porphyrries of the area.

An endeavour has been made to trace the retrogressive changes that took place in the sill after the consolidation of the basic magma. The effect of later intrusion on the quartz-porphyrries is the formation of quartz-diorite.

It is interesting to note that a complete transition, from sub-blastophitic amphibolite (Sp. No. 1/81½) through the massive amphibolite (Sp. No. 1/72) and schistose-gneiss (Sp. Nos. 1/34, T/100 and M/18) to the schist (Sp. Nos. 1/85 and T/101) is exhibited by this small sill.

The area has been subjected to intense folding and imbrication. The low angle fault, that runs from Malwa Tal, passing through 7191 ft. Kulethi peak, the 7th. mile-stone on Ramgarh-Ratighat road, the 33rd. mile-stone on the Almora cart road near Garampani and then extending to Majhera, is a thrust fault, named Ramgarh thrust by the writer.

(The numbers relate to specimens in the author's collection).

10. Xenoliths of Schorl-rock in Granites of Sini, Singhbhum, Dist. Bihar.

R. C. SINHA, Benares.

The paper deals with the origin and detailed microscopic and chemical study of the schorl inclusions in the granites occurring at a distance of half a mile on the south of Sini Railway Station, and the age and origin of the parent rock.

The field work was done during the summer months of 1947 and an area of 24 sq. miles surrounding Sini was mapped on a scale of 1"=1 mile.

The peculiarity found in the granites is that they contain xenoliths of schorl varying in size from a fraction of an inch to 9 or 10 inches in diameter. These inclusions are found to be more frequent and larger in size near the doleritic dykes which traverse these granites. The contact rock contains quartz, feldspars (mostly microperthite) schorl, ilmenite, titanite, biotite, apatite and titaniferous magnetite. The most interesting feature found in these rocks is the frequent occurrence of zonal arrangement of minerals with ilmenite or titaniferous magnetite at the core, surrounded by titanite then apatite and lastly biotite at the extreme periphery.

11. Hybrid-gneisses in Bundelkhand granite, Mahoba, Hamirpur District, United Provinces.

R. C. MISRA, Lucknow.

Besides large exposures of simple granites of various varieties, epidotised granites, and gneisses have been observed in the area. The gneisses for various reasons, based on field relationship, optical and chemical characters appear to be of the composite type. All gradations from granite-gneiss with a few unassimilated black patches to banded gneiss definitely of hybrid nature are seen.

The banded gneisses owe their origin to the granitisation of rocks which may be hornblende-biotite-schists, though the unattacked host rock has not been so far seen in the field. On this account the Bundelkhand granites are assumed to be intrusive into the pre-existing older rocks.

12. Age of the Saline Series in the Salt Range of the Punjab.

A. K. GHOSH, J. SEN, and A. BOSE, Calcutta.

The age of the Punjab Saline Series is still a vexed problem in Indian Geology. E. R. Gee to whom we are indebted for much of our geological knowledge of this area has assigned 'Cambrian' or 'pre-Cambrian' age to the series. B. Sahni, on the other hand, from the evidence of microfossils e.g., woods of conifers, cuticles of grasses, angiospermous wood elements etc., and their repeated occurrence at widely different localities has assigned an Eocene or later age to the Saline Series. The latter according to some geologists is irreconcilable with the field evidence, and they were unable to offer any explanation for the presence of microfossils, stated above.

In view of this great interest in the subject, the authors obtained from Dr. Gee, for analysis, the following rock samples belonging to the Punjab Saline Series and from strata overlying and underlying the series:

- (a) *Vindhya*s—G. 1. (Bijaigarh shales); G. 3-5 (Bituminous dolomite from bore holes at Nagpur, Jodhpur state, Rajputana).
- (b) *Punjab Saline Series*—57/264; 57/267; 57/270-71; 57/280 from the upper and lower gypsum stages at Dandot, Makrach, Khewra and Warcha.
- (c) *Purple Sandstone*—from North of Chenki, Jabbi, Salt Range.
- (d) *Neobolus shales*—k33/591 (b & d) from Kusal fort.
- (e) *Magnesian Sandstone*—6292 from eastern part of Salt Range.
- (f) *Salt Pseudomorph beds*—57/285 (sandstone) and G. 2 (dolomite) from Chittidil; 4977 from Ratucha, Jhelum district.

Of these, samples bearing Nos. G. 1., G. 3-5, and 57/271, yielded no microfossils, following the maceration technique and usual sectioning. Every precaution was taken to prevent any contamination.

The microfossils recovered from (b) confirm the findings of Sahni and his collaborators. But the real interest in our work is the recovery of (i) few multiserial bordered pits and a cuticle, probably of gymnospermous affinity from (c) but not recorded by Hsü (See *Proc : Nat Acad : Sc : B.* 16(2-4), 92, 1946); (ii) numerous pieces of wood often with uni—to multiserial bordered pits and a round pitted spore with triradiate scar from (d); uni—to multiserial bordered pits on carbonized pieces of wood from (e); and wood elements, cuticles and spores of pteridophytic, gymnospermous, and angiospermous affinity from (f) but not confirmed by Lakhanpal and Bhardwaj, *in literis* (Sahni).

Further work is in progress with samples obtained from Prof. Sahni and others. The microfossils recovered so far are few in number in proportion to the large number of preparations examined. From the data in hand i.e., the occurrence of microfossils in beds overlying the Saline Series and of undisputed age (stated above), it is imperative that further extensive work be carried out, for confirmation of the conclusion drawn by Sahni on the age of the series in question.

13. Some Zoo-geographical features of the Mirzapur Vindhya as evidenced by the distribution of fishes.

SUNDAR LAL HORA, Benares.

Two collections of fishes made in the Mirzapur District, U.P., by the Zoological Survey of India are listed and zoo-geographical notes are given regarding the present-day distribution of *Glyptothorax horai*, *Gannandalei*, *Tor kaudree*, *Labeo bolgat*, *Garramullya* and *Puntius amphibius*. The distribution of these fishes supports the hypothesis advanced by the writer several years ago that the Satpuras up to fairly recent times must have formed a continuous high range of mountains connecting the Assam Himalaya on the one hand and the Western Ghats on the other. The fishes listed above represent remnants of five waves of migration which became locked up in the northernmost spurs of these mountains. These waves of migration probably occurred in comparatively recent times and at that period the Ganges and the Son were non-existent in their present form.

14. A new Inter-trappean Charophyte.

SRIPAD RAO Kilpady, Nagpur.

The Charophyta reported from the Inter-trappeans of Hyderabad hitherto, have proved to be very similar to the forms described in recent years from the Nagpur and

Rajahmundry areas. This paper describes an Inter-trappean charophyte from the Gurumutkal area, Yadgir taluq, Gulbarga district which is very different and distinct from those hitherto described from India.

The 'fruit' (oogonium) is very small, slightly vasiform in shape with a rather flat apex and obtusely tapering base. The length is 670 μ and breadth 450 μ and the width of the cells at the equator is about 70 μ . The equatorial angle is 20°. The number of whorls is 10 and the cells are concave on account of incomplete calcification. This form is apparently different from those hitherto described from the Rajahmundry and Nagpur Inter-trappeans.

15. Fossiliferous limestone from near Bhagwi, Jind State, Punjab.

N. N. CHATTERJEE, Calcutta.

The paper gives an account of a fossiliferous limestone bed occurring near the village Bhagwi (28°37' : 76°22') in Jind State, Punjab. The limestone is supplied to the Dadri Factory (28°36' : 76°16') for the manufacture of Portland Cement. The specimens were collected by the author with the kind permission of the Cement Company. The limestone bed occurs at a depth of 2 or 3 feet below the soil. The colour of the limestone is milk white to dirty white or grey and is sometimes slightly buff. The limestone does not seem to be very compact or hard. The quality of the limestone is quite good having the following composition :

Insolubles	2.5%
Fe ₂ O ₃	1.5%
Al ₂ O ₃	0.3%
CaO	51.6%
MgO	1.3%

The limestone is highly fossiliferous and is full of gastropod shells. The gastropods on examination appear to have modern form and fresh water habits. A preliminary examination of the fossils shows the presence of the following genera : Dissostrona; Vivipara; Diastoma; Gibbula; Planorbis; Leptothyra; Radix; and Lymnaea.

The fresh water habit and the modern form of the fossils point to the existence of fresh water basins in which the several families of gastropod flourished and the bed of limestone was formed out of these animal remains. The age of the bed appears to be sub-recent. The author acknowledges the help received from Mr. P.N. Mukerji of the Geological Survey of India in the matter of fossil identification.

16. On the Nature and Probable Age of the Bor Hill Volcanics.

M. R. SAHNI, Calcutta.

Blanford recorded trap representing the Dasean Trap formation, from two distinct horizons in the Bor Hill in the Luki Range in Sind, viz. (1) The Upper trap, being an amygdular flow resting on the Olive shales (*Cardita beaumonti* horizon which is generally accepted as of Danian age, although doubts have been expressed by others in this respect and a somewhat younger age ascribed to the horizon). (2) the lower fairly thick bed of trap which occurs in the sandstone underlying the *Cardita beaumonti* horizon. The sandstone is unfossiliferous, but owing to its lithological resemblance to the Pab sandstone of Beluchistan, and its stratigraphical position below the *Cardita beaumonti* horizon, it is generally assigned to the Cretaceous. On account of the non-amygdaloidal character, the trap may be regarded as possibly of intrusive origin and later than the sandstone. The author has however traced at different horizons in these sandstones in the Bor and the adjoining Barrah hill several outcrops of an amygdular trap which he regards as contemporaneous flows interbedded with the sandstone. The fact is significant in fixing the lower limit of the age of the traps.

In the present state of knowledge the uppermost flow, viz., that overlying the *Cardita beaumonti* horizon is assigned to the post-Danian while the lower flows in the underlying sandstone to the Cretaceous age, although it must be admitted that the age of the sandstone has been deduced only from indirect evidence. Should however the *Cardita beaumonti* beds ultimately prove to be younger than Danian and an examination of microfossils and heavy minerals fail to confirm a Cretaceous age for the underlying sandstone, the possibilities should not be ruled out of the whole sequence being of Lower Tertiary age.

17. The Correlation of the Bijawars and Gwaliors with Delhis based upon the study of Igneous activity at Bayana in Bharatpur State.

V. S. DUBEY and B. D. PATHAK, Benares.

Recently the writers while carrying out the geological survey of the Bharatpur State studied the basic lavas occurring in the Alwar Series near Bayana in the Delhi System. The character of these lavas and the degree of the metamorphism, and the nature of the associated rock clearly resemble those of the basic lavas occurring near Ranthembhor which is about fifty miles from this area. The lavas of Ranthembhor are clearly known to belong to the Gwalior Series and are exactly similar to those found near Gwalior town. From this correlation it is clear that the lavas of the Delhis and the Gwaliors are of the same age. This clearly strengthens the view that the Delhis and the Bijawars are of the same age, and that the Delhis of Bayana consisting of quartzites may be contemporaneous with the Par quartzites of the Gwalior and other quartzites of the Bijawar series.

18. A Contribution to the Stratigraphical Position of the Dharwar Rocks, Singhbhum District, Bihar.

R. C. SINHA, Benares.

The paper deals with the stratigraphical position of the Dharwar rocks of Singhbhum District (Bihar). The conclusions are derived mainly from field observations and detailed mapping done by the writer during the summer months of 1947, in the area surrounding Sini in that district. Dunn (Mem. G.S.L., LIV, 1929, p. 11) has discussed the order of superposition of the rocks of Northern Singhbhum, but the present writer is not in full accord with Dunn's conclusions especially in the light of the observations made by him on this area. After a detailed discussion of the various views of Dunn (op. cit.) and Jones (Rec. G.S.L., LIV pt. 2 p. 207) together with those of others, the writer gives his own conclusions as regards the stratigraphical position of these rocks which is as follows :—

Lower Cuddapah Newer Dolerite

	Granites and aplites
	Schists bearing copper lode
	Ultrabasic rocks
Dharwars	Phyllites and chlorite schists
	Kyanite schists and schists bearing
	staurolite crystals together with quartzites and conglomera-
	merates.
	Mica and hornblende schists (mainly hornblende). Base not seen

Further the view held by several of the previous authors that the Dharwars are entirely of igneous origin, the hornblende and chlorite schists being representatives of altered basic igneous rocks and that no transition from phyllites to schists are found, has been contradicted. Very clear transitions from phyllites to mica schists and thence to chlorite schist have been found and thereby the undoubted sedimentary nature of Dharwars, at least in this area has been observed in detail.

19. The Geology and Stratigraphy of Jhura Hills, Cutch State.

S. K. AGRAWAL, Benares.

The paper gives an account of the geology and stratigraphy of the Jhura Hill, N.W. of Bhuj, in the Cutch State. Detailed mapping of the area on a scale 4" = 1 mile, was done in the winter months of 1946 for the first time under the guidance of Prof. Raj Nath. The rocks occur in the form of a dome and hence show radial dips. The dip values are high to the north and gentle to the south. The rocks are further affected by faults and igneous intrusions in the area. The rocks consist of shales and various types of sandstones belonging to Chari Series and the lowest bed is probably of Patcham Series. They have been subdivided into 18 divisions on lithological characters in the Series. The fossil collection consists of field and fossil collections were separately made from each. The fossil collection consists mostly of ammonites, brachiopods, lamellibranchs, along with gastropods, echinoids, corals and fossil plants. The fossils are at present under investigation by the writer.

20. The Geology of the Habo Hills, Cutch.

B. S. TIWARI, Lucknow.

The paper embodies the results of detailed geological mapping of the Habo Hills between latitudes $23^{\circ} 20'$ — $23^{\circ} 23'$, and longitudes $69^{\circ} 47'$ — $69^{\circ} 56'$, during the months of October, November and December, 1946. A systematic collection of rocks and fossils has been made.

The formations present in the area belong to the Chari and Patcham series. The writer has made observations regarding the dome structure of the hills, which is mainly due to the large scale igneous intrusions probably connected with the Deccan Trap activity.

The paper describes the lithology and stratigraphy of the area. The fossil collections are being examined.

21. A contribution to the Geology of the Ramgarh Area, Nainital District (U. P.)

I. C. PANDE, Benares.

A survey of the geology of the Ramgarh valley ($29^{\circ} 26'$: $79^{\circ} 41'$) and of adjacent areas, revealed interesting facts concerning lithology, stratigraphy and structure, which are recorded in this paper.

The Ramgarh valley was mapped on $12'' = 1$ mile scale in the summer and autumn months of 1940, summer of 1943, autumn of 1943, summer of 1945 and spring of 1946. The part mapped is bounded by latitudes $29^{\circ} 23'$ and $29^{\circ} 30'$ and longitudes $79^{\circ} 26'$ and $79^{\circ} 38'$.

The Ramgarh and adjacent hills belong to the Gagar Range of Kumaon and form the outer part of Nag Tibba Range of the Lesser Himalayas. The geological column includes a complex series of quartzites, grit, various schists (quartz-muscovite, muscovite-chlorite, and hornblende) and sheeny schistose phyllites (chlorite-sericite, sericite-chlorite, and talc).

The schistose phyllites were intruded by acid rocks (quartz-porphyrries) and migmatized to gneissose quartz-porphyrries. At a later stage the quartz-porphyrries were intruded by an epidiorite sill which has given rise to quartz-diorite near its contact.

The metamorphic series of the present area has been correlated with the "Inner Schistose Series" of the Himalayas which again on the basis of lithological and stratigraphical evidence is here considered to be of Jaunsar age. The rocks are devoid of fossils and hence the age assigned cannot be regarded as final at the present stage.

22. Asbestos in Nikumbh area, Gwalior State.

K. V. KRISHNAMURTHY RAO, Gwalior.

Asbestos, both of the crossfibre and slipfibre types is found two furlongs west of Nikumbh (Jagir Village) in the Neemuch Paragana, Mandsaur District. It is fourteen miles west of Nimbahera Ry. Stn. on the Ajmer-Ratlam section of B.B.& C.I.Ry. It is of the amphibole variety and found in association with quartz at the contact of veins of quartz in hornblende trap. Contact effects are clearly visible in quartz. Serpentinisation in trap is abundant. The trap is highly calcareous and is in contact with the Aravalli slates and shales in the type area. Similar serpentinisation in trap has also been noted a few yards north of Padlia (Gwalior), six miles south of Nikumbh. The trap stretches south from Nikumbh for nearly eight miles and is on the average about a mile wide.

The mineral is white and soft. The veins are from 0.2' to two inches in width. Fibres have no tensile strength and break. The occurrence may be similar to that of Bundi (Coulson, Asbestos Memoir).

Since the intervening stretches between Nikumbh and Padlia lie in Mewar and Tonk States, a full examination of the trappean area could not be done. Since the area covered by the traps is by no means negligible, it is suggested that a thorough examination of the area may be taken up.

23. Bauxite Deposits of Amarkantak Plateau, Rewa State, Central India. B. S. TIWARI, Lucknow.

A survey of bauxite deposits of this region was carried out in January 1946 and the main observations obtained in the field and laboratory are summarised in the present paper.

The best ore containing 60-65% alumina occurs along the periphery of the plateau. Ores containing less alumina are scattered at various places all over the plateau. The area has been geologically mapped by the author. The most economical way of exploiting the ore is suggested in this paper.

24. The Chromite Deposits of Kondapalli, (Kistna District). B. R. CHELUVA IYENGAR, Bangalore.

The chromite deposits of Konadapalle are situated in an area ($16^{\circ}37' : 80^{\circ}32\frac{1}{2}'$), about 10 miles to the N.W. of Bezwada. The geological features of the area comprise, the Bezwada gneisses, the granitic gneisses and the Charnockites, and the chromite deposits are restricted to the ultrabasic Charnockites, mainly the pyroxenites (Enstatite-hypersthene rock). The occurrence of the ore is chiefly in the form of pockets or lenses in disseminated patches and often in regular and perfect bands. No olivine has been found but the serpentine noticed in certain places is due to the alteration of pyroxene. Six complete chemical analyses of representative chromite ores from the area show that the value of the Cr_2O_3 of the ore ranges from 36 to 55 per cent. The detailed field and petrographic studies indicate that the chromite of Kondapalle is magnetic in origin, the ore crystallising as the first mineral and later joining with the orthopyroxene.

25. X-Ray study of some Indian Coals.

N. N. CHATTERJEE and N. N. GUPTA, Calcutta.

The authors have given an account of X-ray photographs (X-radiographs) of the following samples : (i) Seam No. V, New Gobindapur colliery, Jharia ; (ii) Seam No. V, North Bhuggatdih colliery, Jharia ; (iii) Seam No. IX Dhansar colliery, Jharia ; (iv) Seam No. X Rajapur colliery, Jharia ; (v) Seam No. XIII North Damuda colliery, Jharia ; (vi) Nega seam, Raniganj coalfield all belonging to the banded bituminous type ; (vii) Palana lignite from Bikaner ; (viii) Wanching bright coal from upper Assam ; (ix) Jammu anthracitic coal from Kashmir. (i) to (v) of Barakar age ; (vi) of Raniganj age (vii) to (ix) of Eocene age.

X-rays were allowed to fall on thin slices (1-1.5 mm thick) of coal cut at right angles to the bedding planes. The work was carried out in the Laboratory of the Indian Association for the Cultivation of Science, Calcutta with kind permission of Prof. K. Banerji and the X-radiographs were taken with the help of Mr. N. N. Gupta. In these experiments Hadding- Seighbahn x-ray tube with aluminium cathode and copper target was used.

The X-ray photographs show clearly the difference in the amount of absorption of X-rays by the vitrain and durain bands. Vitrain or bright band appears transparent as it has the minimum absorption.

The arrangement and distribution of the mineral matter and its grain size have been faithfully brought out in the photographs of the lower Gondwana bituminous coals. The mineral particles are present in these coals mostly in very minute size (less than 0.1 mm) and they are found to be irregularly distributed. Few bigger particles are also present, the maximum size being 0.5-1 mm. The Eocene coal specimens contain insignificant amounts of mineral particles showing more or less the purity of the coal substance. The ash of the Tertiary (Eocene) coals varies between 0.5-12% and that of the Lower Gondwana coals between 10-30%.

The very minute size of the mineral particles as represented in these photographs tends to show that it would be rather impossible to remove these particles of inorganic matter by any method of washing unless the coal is ground down to that fineness which however does not seem to be a practical proposition.

26. Diamondiferous plug in Panna State, C.I.

V. S. DUBEY and SUKUMAR MERH, Benares.

Diamonds are known to occur in Rewa Conglomerates in Panna State but the exact source from which they are derived was not known. Recent work has located a diamondiferous plug covering an area of about 2,00,000 sq. ft. The rock is ultrabasic in

nature, similar to Kimberlites of S. Africa. It is post-Bijawar and belongs to the Gwalior Trap igneous cycle. The Gwalior or Bijawar trap was followed by these diamondiferous ultrabasic rock intrusions followed by granite. The diamond content on an average is one carat per four tons of rock which is similar in magnitude to that found in the Kimberley mine. The diamonds are of quite high quality and are upto 40 to 50 carats in weight. The plug probably goes very deep, and at the rate of four tons per carat, the diamonds in the upper 3000 feet are about 5 lakh carats in weight and Rs. 50 crores in value. The deposit is commercially workable. Petrological, geological and stratigraphic details about the plug have been given in the paper and its commercial utilisation has been discussed.

27. Iron-ore deposits of Mandi State.

V. S. DUBEY and SATISH CHANDRA GUPTA, Benares.

In a paper published in the Quarterly Journal of the Geological Mining and Metallurgical Society of India in 1930 Dr. S. K. Roy suggested that there are big deposits of iron ore in Mandi State. The writers realise the possibility of the development of the iron and steel industry from the ore deposits by the electro-smelting process, now so well practised in Norway and Sweden, as cheap Hydro-electric power is available at Jogindernagar, Mandi State and more power can be developed at cheap rates.

The possibility of this development, so much needed in the northern zone of India, induced the writers to take up the investigations of the raw materials and power resources as well as the question of cost.

The availability of iron ores, charcoal and limestone has been considered and the possibility of generating hydel energy has also been investigated. As a result of this investigation the writers are satisfied about the cost of raw materials and the power, but the results of their investigations to date do not confirm Roy's estimate of the quantity of iron ore.

According to the writers' estimates, the ore exposed at the surface is of the order of 100,000 tons and it is only by magnetic surveying and drilling that one would be able to state whether or not large quantities of the ore such as are visualised by Roy are present underground.

Further they are unable to confirm Roy's observations that (1) the ore-body extends to a great distance in the N-W. direction along the Charayan dhar, and (2) the Charyan dhar deposit extends up to Sandalwara area.

The above remarks are based on about two months' field-work which is however being continued to examine further evidence, if any, of the possibility of the occurrence of an extensive deposit of iron ore. Should a sufficient quantity of ore exist, it would be possible to develop a steel plant of 100-ton capacity in the area.

28. Suitability of limestones for making Pig and cement from Indian Iron Ores.

R. GHOSH and R. K. DUTTA ROY, Calcutta.

Indian iron ores are exceptionally pure and as such permit the use of inferior grades of limestone than hitherto practised in spite of the fact that Indian cokes are invariably rich in ash-content. The slag, a bye-product in the iron industry, produced by the use of such inferior quality of limestone will be available for the manufacture of cement.

29. On the origin of laterites from Deccan Traps of Vikarabad area, Hyderabad State.

G. VENKATESWARA RAO, Waltair. (Communicated by C. MAHADEVAN)

Laterites which cap the Deccan Traps 'in situ' in Vikarabad area in Hyderabad State are slightly more siliceous than those in other areas. Lateritisation is effected through the zones of kaolinised trap, lithomarge and variegated clayey layer. The silicates in the parent rock are acted upon by carbonated waters during the wet season converting them into carbonates which are oxidised later on to oxides. These are concentrated during the dry season when, due to capillarity, an electrokinetic charge is developed in the colloidal state of decomposed materials. The migration of the electrically charged particles and their concentration depend upon the sign of the electricity produced and the valency of the radical. Further alumina is at its maximum as is seen from analytical data just above the zone of lithomarge and at the bottom of the variegated clayey layer. This acts as a semi-permeable membrane which allows only selected

colloid particles upwards. A phenomenon of cataphoresis occurs producing chemical separation. The concentration is aided by the nature and behavior of 'sols' which are the immediate products of decomposition. The 'sols' of higher valency elements are converted permanently to 'gels' in the presence of an electrolyte which settle down but those of lower valency are reconverted to 'sols'.

30. Common Salt deposits of Bharatpur State.

V. S. DUBEY and B. D. PATHAK, Benares.

More than a century ago salt was manufactured extensively in Bharatpur State. The production was quite large. This was stopped when salt became government monopoly. There are a large number of big wells which contain highly saline water. This water was evaporated in the sun to get salt. A detailed study shows that there is a belt which contains highly saline underground water in the Bharatpur State, the salinity not being confined to the surface but being connected with underground geological factors. The view of the writers is that there is a saline belt in this area similar to Sambhar area. Large amount of salt solution can be obtained which on evaporation will yield good salt. A pumping of twenty-five thousand gallons per hour which is quite practicable will produce about 25000 to 30000 tons of salt per annum. Hence the capacity from this source can easily be about 30,000 tons in a year. It can become important due to the passing of the well-known Khewra deposits of the Salt Range to Pakistan.

31. Some Economic Minerals from Dewarkhand and neighbouring area (Chota Nagpur).

R. S. MITHAL, Benares.

The paper deals with the economic aspects of some minerals collected from Dewarkhand and neighbouring areas of the Chota Nagpur Raj.

The coal in particular and limestone deposits worked at Ray, Karkata etc., have previously been referred to by A. Jewett (Mem. G.S.I. LII Part I—1925). The other economic minerals and rocks recorded by the present author for the first time are :—

1. Mica at Chama (23°35' : 85°1')
2. Felspar at Aktan (23°37' : 85°7') Ichapeeri (23°37' : 85°14') Arid (23°37' : 85°10')
3. Quartz at Hoyer, Aktan, Ichapeeri and Sarle
4. China Clay at Sarle (23°28' : 85°6') Babbne (23°39' : 85°5')
5. Fire Clay at Ray (23°46' : 85°4')
6. Quartzite at Mankitand (23°39' : 85°1'), Hoyer and on the way from Babbne to village Sarle.

The mode of occurrence, extent, the economic utility etc. of the newly recorded minerals are discussed in this paper. These minerals are of good quality. They are economically workable as they occur in considerable quantities and in fairly easily accessible localities.

Mica, quartz, felspar, china clay and fire clay are suitable for usual purposes and the quartzites can easily be used for the manufacture of glass.

32. The Peridotite rocks of Manpur, Dhalbhum Subdivision of the Singbhum District and the Origin of the associated Asbestos Deposits.

S. C. CHATTERJEE, Patna.

The peridotite rocks form irregular dikes and inclined sheets intruded into the Singbhum Granite and the phyllites and schists of the Iron-ore Series. They consist of hypersthene with clear pleochroism from pink to green, olivine with its alteration products, and magnetite which is both secondary and primary. The paper gives detailed petrographical description of the different types of rocks and their constituent minerals. The granite rocks are more basic in this area than the typical Singbhum Granite and are altered into chlorite-bearing schists.

The asbestos veins consist of unusually long fibres of chrysotile and are derived from the olivine. Field and microscopic evidence indicates that the serpentinisation of the ultrabasic rocks was not due to the influence of hydrothermal solutions from younger acid intrusives, but an auto-metamorphic phenomenon due to the action of late-stage hypothermal solutions (hypohydrous of Hess). The transformation of

serpentine to veins of chrysotile is discussed and field and microscopic evidence is brought forward to show that the deposit can be best explained by following the replacement theory of Bateman.

33. Microscopic characters of some Copper-bearing, Metamorphic Rocks from the Khetri Mine area, Rajputana.

S. DEB, Calcutta.

Metamorphic rocks from this region containing traces of copper minerals have been examined under the microscope in thin sections and in polished sections. Carbonate minerals are usually found to occur in the secondary enrichment zone as superficial incrustation on most of these metamorphic rocks. Sulphide minerals are found to be in a highly disseminated condition and occur only in amphibolites and garnetiferous quartzites. The degree of metamorphism as noticed under the microscope is less intense than in the older rocks of the Aravalli Archæans. The rocks are mostly chloritic quartzite with magnetite, garnetiferous hornblende-schist, amphibolites, tremolite-chloritic-quartz-schists, impure felspathic quartzite, and actinolite-tremolite schists.

The rocks belong to the Alwar or Ajabgarh Series of the Delhi System which occur in this part of Rajputana.

34. Fossil tortoise shell from Worli Hill, Bombay.

P. N. MUKERJEE, Calcutta.

The fossil specimen was sent to the Palaeontologist, Geological Survey of India for identification and determination of the geological horizon by Dr. S. L. Hora, Director, Zoological Survey of India. The specimen was collected by Mr. R. N. Sukheswala of Bombay. This fossil specimen was already recorded in the abstracts of the Indian Science Congress for 1946, p.97, as *Testudo Leithii*. The specific name should be *Hydraspis Leithii* Gray.

The fossil species is very closely related, if not identical with *Hydraspis Leithii* Gray (*Testudo Leithii* Carter). Several fossils of this species have already been recorded from the fresh water formation of the Bombay Island. The characters of carapace and head suggest that the genus is allied to the existing South American genus *Hydraspis*. *Hydraspis Leithii* Gray should not be confused with *Testudo Leithii* Gunther, a true land tortoise closely related to *T. marginata* of Europe.

Microscope slides, of the rock in which the fossil is embedded, show volcanic tuff material of the Deccan Trap indicating a Lower Tertiary age of the animal.

35. On some sub-fossils of the Pulicot Lake, Madras Presidency, South India.

S. S. SARKAR, Rangoon.

In 1869, William King of the Geological Survey of India collected some fossil specimens from the Pulicot Lake ($18^{\circ}25'-13^{\circ}45'$: $80^{\circ}-80^{\circ}17'$) about 32 miles N. of Madras on the east coast.

With the kind permission of the Director, Geological Survey of India, the specimens were examined and the following are the identifications :—

Mactra, *Cardita*, *Crassina*, *Astarte*, *Tapes*, *Ostrea*, *Dosinia*, *Diplodonta*, *Venus* (*Omphalocladum* cf. *puerpera* Linn.), *Macrocallista* cf. *Casta* Lam., *Macrocallista* (?) *Castanea*, *Batissa* cf. *crawfurdi* (Noet.) *Arca* *pilula* (Reeve), *Trachycardium* cf. *Sindiense* (Vred.) *Indonaiia glyptica* (Prashad), *Placuna placenta* Lam., *Dissostoma*, *Terebralia subligitarum* (Vred.)

The nature of deposition is a mixed one showing mostly marine, with others indicating fresh-water, estuarine or terrestrial habitat.

The general faunal assemblage suggests a Pleistocene age.

36. Mechanical Analysis of some Gondwana sandstones (South West corner of Raniganj Coal field).

SAURINDRANATH SEN and SUNIL KUMAR RAYCHAUDHURI, Calcutta.

Sandstones from Raniganj, Panchot and Supra-Panchot stages, collected from (Bisram jhor section and Panchot hill, and the Machkonda jhor section and Gorangi

Peak were subjected to size-grade analysis. The samples were disaggregated carefully by keeping them under water which was in some cases slightly acidulated (HCl). After pouring off the suspended matter and the finer particles under a mild current, the dried samples were passed through I.M.M. sieves 30-200 mesh. The grains passing through 200 mesh and those decanted and elutriated off were recorded as finer than 200 mesh and plotted as of size with mean diam. between 1/16 mm to 0 mm.

Frequency polygons of 5 samples of Raniganj, 3 of Panchet and one of Supra-Panchet sandstones were prepared. It is seen from them that Raniganj samples are decidedly finer grained and one specimen 48a is a shaly sandstone while specimen 38a is calcareous. Three samples show maximum sorting with decided concentration at two size limits: 0 to 0.085 and 0.16 to 0.18 mms, the other grades are either totally absent, or if present, not exceeding 5% of the total bulk. The three samples of Panchet sandstones show the maximum peaking at the coarser grade 0.42 to 0.50 mms. All of them present four such peaks at 0 to 0.12, 0.16 to 0.18, 0.25 to 0.32, 0.42 to 0.50 mms. The specimen from Supra Panchet also shows four peaks at the identical size grades and the peaks are more or less equal. The following tables on Udden scale brings out these characteristics clearly, but the nature of sorting and the tendency in charge of the variables come out significantly in the Frequency polygons.

Grades in mm.	48a	38a	46a	45e	45g	53
$\frac{1}{2}$ to $\frac{1}{4}$ mm	00.00	00.15	01.42	21.82	63.12	49.94
$\frac{1}{4}$ to $\frac{1}{8}$ mm	16.73	07.43	17.39	38.57	14.58	18.99
$\frac{1}{8}$ to 1/16 mm	37.33	30.57	52.74	16.76	11.15	15.08
1/16 to 0 mm	46.94	61.85	28.45	21.84	12.15	15.99
Grades in mm	39	55	7			
$\frac{1}{2}$ to $\frac{1}{4}$ mm	55.72	78.57	38.23			
$\frac{1}{4}$ to $\frac{1}{8}$ mm	17.73	15.22	32.10			
$\frac{1}{8}$ to 1/16 mm	25.66	00.00	16.19			
1/16 to 0 mm	00.39	06.21	13.48			

37. Petrotectonic study in the Darjeeling Himalayas.

S. K. RAY and S. SEN, Calcutta.

A detailed study of progressive metamorphism of the argillaceous and associated basic and arenaceous series has recently been completed by the senior author. The specimens collected though not oriented have been subjected to mineral fabric analysis. Geotectonic interpretation of the fabric cannot be attempted seriously at this stage; this study is a preliminary to a further detailed and systematic study.

The quartz fabric diagram in the *ac* plane of a specimen from the garnet zone (132) shows a scattering of points with little tendency to form prominent maxima. The concentration nowhere exceeds 5% and there is an absence of statistically preferred orientation. The *ac* quartz fabric diagram of another specimen from garnet zone (104) also lacks in preferred concentration or definite maxima though it shows a double girdling one on the *bc* plane and another diagonal which has a tendency to split up into an *ac* girdle. The *ac* quartz fabric of a specimen from kyanite zone (121) shows a girdling on *ac* plane round *b* which splits up into a diagonal girdle in the *ac* plane. One maxima somewhat prominent (with a maximum concentration of 7.14%) is developed between *b* and *c* near the maxima III of Sander's synoptic diagram.

The possible implications of the diagrams are that preferred orientation was by solid flow or dragging giving essentially monoclinic symmetry.

B. Geography

1. Need for a short term plan for the tract inside the Damodar Elbow.

S. C. BOSE, Calcutta.

After the destruction of the embankment to the south and west of the river in this tract, in the inundation of 1855, it was abandoned. The embankment on the opposite side was however strengthened, raised and duplicated after every major flood disaster. In short, the river was given a free hand inside its elbow. Though it meant an annual supply of silt fertilizing these lands, the maladjustment created by the one-sided embankment slowly resulted in the gradual transformation of a belt of agricultural land into sandy barrens and savannah. Loss of standing crop, cattle, property and even obliteration of villages continued. Even now the destruction is proceeding at a rapid rate, especially where the Mohanpur Hana, a new enlarging spill channel is creating havoc every year. Thus a quick short term plan is needed to stop further rot. The Damodar Multipurpose Scheme which is still in the embryo may take five years or more to give relief to this piece of stricken land.

2. The valleys of the beheaded streams Khari, Banka and Behula in Burdwan District (West Bengal).

S. C. BOSE, Calcutta.

The Damodar used to flow in the past straight towards the east, joining the river Hooghly above Calcutta. It has changed its course several times with disastrous results. Rennell's map shows it flowing along the bed of the Ghea Nadi of today. Earlier the Damodar occupied the beds of the Khari, the Banka and the Behula successively. They are thus beheaded streams, and their present catchment is severely restricted. Their diminishing volume is reflected in their tortuous meandering courses.

The Khari, the northernmost of these streams, has the biggest catchment. It cuts through old alluvial beds deposited by the Damodar in the past, and at present being dissected and moulded by stream action. The Banka is artificially separated from the Damodar by the embankment in between. The Behula is so much emaciated that it is difficult to recognise it as a river. Even so, in 1943, it temporarily regained its old form, when the Damodar burst its embankment at Manikhati and rushed madly into it.

The beheading has caused a general dryness of the land, accentuated by the sandy character of the soil, the raised alluvial blocks and benches being the worst sufferers. Much land has been encroached upon by dry scrub jungle. The Damodar canal was built to relieve these conditions. But unfortunately it has been a partial success, the planning and execution of it having been done without a proper geographical analysis. The same tragedy should not be repeated and geographers should play their part in the Damodar Valley Corporation to be constituted in the near future.

3. Reviving the great Indian desert.

MANECK B. PITHAWALLA, Karachi.

A news item was recently flashed from Delhi that the Sind-Rajputana desert was spreading northward and eastward and that too at the rate of half a mile per year. The author has tried to answer this in a brief paper dealing with the physiography of the Great Indian Desert and suggested some ways of reviving the region with the aid of the Engineering Science. Travellers through the desert area, like the late Sir Aurel Stein, have come to the conclusion that the Indian desert is *not a real desert*, but there have been some natural catastrophies such as hydrographical changes and some human interference with nature in the upper reaches of the Ambala streams, such as the destruction of forests, over-grazing, over-irrigation etc. The triple river system of the Ghaggar, Hakra, Wahinda and the Eastern Nara, must have watered, even till late historic times, some 7000 square miles of the now barren land in the north and the west of the Thar.

In recent years and after the construction of the Sukkur barrage, the Eastern Nara has been greatly revived and nearly the whole channel has been converted into a first-rate perennial canal with some 10,000 miles of water courses taken from it. Such a transformation can also be produced in the old Ghaggar-Sarasvati channel in the north of the desert, as there is enough water in the Sutlej to rejuvenate it. In spite of the

new irrigation projects coming into force both in Sind and the Punjab, some 100,000 cusecs of water will still continue to run to waste into the sea. Towards the eastern part of the desert, much can also be done to control the Luni river system with its half a dozen powerful tributaries. There are a large number of natural reservoirs called *jhils*, which can be prevented from turning into saline lakes with skilful damming and river-training work. Thus there is a tremendous scope for undoing what man as well as nature have done to increase barrenness.

The Paper is accompanied by maps of the desert specially drawn to illustrate its physiography and physiographic divisions and deals with various engineering schemes for conserving the water in this region and for belying the above news item.

4. A geographical survey of Keamari and its gradual growth as a satellite of Karachi City.

MANECK B. PITHAWALLA and THOMAS HOWELL, Karachi.

In this paper the geographic aspects of Keamari have been examined step by step. The various factors which are likely to foster or retard the development have been laid bare. Emphasis has been placed on the fact that Keamari reflects the prosperity of Karachi as the parent city, with which it is connected by road and rail.

A detailed account of the living conditions in the area is given, pointing out certain defects which could be remedied, if better planning is instituted.

Any industrialisation of the area has been deprecated, as the satellite's main function is to foster the harbour and its trade and as it would add to the existing congestion and insanitation.

5. The new climatic Divisions of Sind.

MR. G. S. RAISINGHANI, Nawabshah, Sind.

The writer has carried out field surveys, examined the geographical conditions and the economic resources of the province of Sind with a view to prepare a detailed plan for its economic development. The climate has got profound influence on the soil conditions, natural flora, irrigation method and practices, plant growth, crop maturity and yield, industries and human settlements. As a first step towards economic planning, the author, therefore, prepared a map showing climatic divisions of Sind.

Pithawalla (1937) divided Sind into three transverse and more or less parallel climatic divisions viz : I. Upper Sind ('Siro') ; II. Middle Sind ('Vacholo') and III. Lower Sind ('Lar'). But the rainfall figures, wind velocities and maximum and minimum temperatures reveal that there are four definite and distinct climatic divisions into which Sind can and should be divided. This necessitates and involves not only revising and shifting of the old boundaries of Pithawalla's three climatic divisions of Sind but justifies splitting up of Pithawalla's Vacholo climatic division into two divisions longitudinally viz 1. Eastern Vacholo Division and 2. Western Vacholo Division.

The paper describes the climatic conditions based upon wind velocities, maximum and minimum temperatures and rainfall figures of each division.

The paper is accompanied by maps of Sind showing Pithawalla's and the author's climatic divisions.

6. A Geographical Analysis of Natural Vegetation of Sind.

G. S. RAISINGHANI, Nawabshah, Sind.

The paper represents a study in plant geography with special reference to the geographical distribution, classification and migration of natural vegetation, industrial as well as other possible economic uses and medicinal properties of the flora of Sind.

The author, after discussing the principles of Plant Geography based upon the responses of plants to their environment and tracing the history of the study of the natural vegetation of Sind from 1847 to 1947, describes Sind's unique floristic composition and the distribution of natural vegetation on the basis of geographical conditions prevailing in each physiographic division of Sind. It has been shown that natural vegetation being an index of soil conditions, is an aid to soil classification *in situ*.

In the light of the author's new four climatic divisions of Sind, the climatic conditions of each division have been described and the scope of wind and water as ag-

cies for the dispersal of seeds and colonisation of flora in various parts of Sind has been examined. The influence of wind on the migration of flora from the Thar Desert and colonisation in the valley sections has been studied in detail. A list of such emigrant plants has been given and a path of migration has been mapped out. The correlation between the direction of winds, the drifting of sand and the translocation of the flora has been established. It has further been shown that the Laki Range hinders the passage of wind-borne seeds and thus prevents the colonisation of flora of the eastern parts in the western parts.

The general xerophytic characteristics of natural vegetation of sind have been described and affinities between geographical condition and the flora of Sind, Arabia, Egypt, Nubia, the Punjab, Afghanistan and the rest of India have been pointed out. Whereas the Lloyd Barrage in Sind and the enormous water withdrawals from the river Indus in the Punjab have had deleterious effects on the forest vegetation, the other natural vegetation has become richer since the functioning of the Lloyd Barrage. With the advent of perennial irrigation, '*Kal*' (*Cyperus rotundus*), '*Pan*' (*Typha elephantina*), '*Sar*' (*Sachharum spontanium*) and '*Dhaturo*' (*Datura stramonium* and *D. fastuosa*) have sprung up in such large numbers that owing to their rapid and persistent growth in the valley sections, they are a serious menace to irrigation and agriculture.

As Pithawalla's 6 Vegetation Belts of Sind (1937) do not include the characteristic Halophytic, Aquatic, Kalarsoil, Ruderal and the Railwayline Side Vegetation Formations, the author has classified the natural vegetation into Formations according to the Schimper's definition of the terms, viz: 1. Halophytic, 2. Mangrove, 3. Aquatic, 4. Kalar soil, 5. Sand, 6. Gravel, 7. Rock, 8. Ruderal, 9. Forest, 10. Cultivated land and 11. Railwayline Side Vegetation Formations.

The flora of each Formation is enumerated and the entire natural vegetation has been analysed according to the habitat, the habit of growth and the adaptive characters. The mechanical and chemical analyses of typical soil profiles supporting different Vegetation Formations have also been given.

The paper is accompanied by a number of maps, an exhaustive Bibliography and a long list showing industrial or other possible economic uses and medicinal properties of the flora of Sind.

The author's present investigation is a part of his work of National Planning in Sind for which he has received a research grant from the University of Bombay.

7. Hydrology of the Upper Ganges Basin.

D. R. SINGH, MEERUT and M. B. PITHAWALLA, Karachi.

The paper is one of a series of papers on the regional study of the Upper Ganges Basin, the physiography, climatology, etc., of which were dealt with in the sessions of 1943, 1944 and 1947.

It deals with the Ganges, its two voluminous tributaries, the Jumna and the Gogra, together with the Ramganga, the Gumti, the Sarda and other smaller rivers.

The rivers of the Basin play a very important part in its wealth and particularly the Ganges is the most convenient source of power in the Basin which has no coal. There are numerous potential possibilities of these rivers on which single, dual and multi-purpose development schemes are possible.

The hydrological data and particularly records of discharges and fluctuations of level and sub-soil water are not available, and where available, are very poorly maintained. If the rivers are tube developed on multi-purpose basis, there will be a great need of opening up more stream gauge stations and of mobilizing the services of geographers, hydrologists, geologists and foresters.

The paper is illustrated with necessary maps, sketches, graphs, etc.

8. Industrial problems, Development and Planning with regard to the Lower Godavari Region.

V. L. S. P. RAO, Calcutta.

In this paper the author examines the scope for industrial development and planning in the Godavari region. The geographic basis and problems of important industries like paper, rice milling, ceramics, sugar, tobacco, etc., are discussed.

Out of the total population of 18,80,000, the number of operatives employed in the factories is nearly 7200. (i.e. 0.39 percent of the total population which is just below

the Presidency average of 0.42 percent). Out of the 7,200 factory workers, 4,477 are engaged in agricultural industries. Keeping in view the principles of regionalisation and on the basis of the character of regional resources and the nature of raw materials consumed by the existing industries and assuming that the power problem is going to be solved either by hydro-electricity or thermal power, because the region cannot rely on coal as a cheap source of power, industries like the alkali industry, sawmill, match factory, plywood industry, fish oil and fish meal etc., can be developed in the region.

If the industries of the region are going to be planned according to regional concepts, the existing three fold classification of the Godavari region into Agency, Uplands and Delta cannot be accepted. The author suggests eight regional units and emphasises the need for an Industrial Planning Committee with definite objectives, six of which have been suggested above.

To conclude, the Godavari region possess varied resources, required capital and adequate labour; what is needed is better co-ordination. The limited mineral deposits like graphite and kaolin should be more carefully utilised. It is doubtful whether industries could be developed to such an extent as to absorb a vast majority of the agricultural population of the region. Agriculture and industry can be integrated by proper regional planning. Vested interests and narrow outlook of the Godavari capitalists and industrial organisers are playing havoc. The neutral policy of the Madras Government has to be given up. The tendency of every potter to become a crucible manufacturer should be sternly discountenanced; the Godavari industrialists' policy of waiting 'till the apprentice fitter coolie becomes a technical expert' should be abandoned once and for all and the practice of toying with industrialisation generally should be penalised. The Godavari industrialists should be permitted to start industries only after the approval of the Industrial Planning Committee.

The landscape, personality and the geo-economic factors should determine the future character and pattern of industrial planning and development in the Godavari region which, as such, has no personality of its own and hence, should be considered as a part of the Northern Circars Region, not only for the purposes of industrial planning but also for regional planning.

9. Calcutta and the industries in its Suburbs.

P. C. CHAKRAVARTI, Calcutta.

Calcutta maintains a high population. Labour is cosmopolitan, abundant and efficient. Consumption of finished goods of various orders is great. Both heavy goods and light industries (cottage) would not only find a ready market but also solve the problem of unemployment to a certain degree. Again supply of commodities to markets according to the demand, would make the city self-sufficient. Some of the raw-materials are to be imported no doubt, but industries of various types would change the social condition and the general outlook. Care must be taken to leave untouched the green belts. Location of these industrial concerns must also be away from residential quarters.

10. The Origin of Forces responsible for Disruption of Continents, Mountain Building and Continental Drift.

H. L. CHHIBBER, Benares.

The chief factors causing the disruption and drift of continents and mountain building are radioactive disintegration and evolution of heat leading to the melting of rocks and their subsequent intrusion and extrusion and the ultimate foundering of large portions of the crust leading to its invasion by the sea; loss of heat, resulting in contraction causing mountain building on the one hand and geosynclinal depressions on the other; tension arising as a complement to compression in the adjacent mountain forming area, and being ultimately responsible for the drifting of the disrupted parts of continents.

11. The Origin and Permanence of Ocean Basins.

H. L. CHHIBBER, Benares.

The term permanence of ocean basins has been employed in a vague and loose sense. Even submarine volcanic eruptions interfere with their permanence. Even in bir, oceans like the Pacific, volcanic islands spring up in the middle or anywhere. More over

the upheaval of the geosynclinals, disruption and drift of continents, interfere with the permanence of ocean basins. The wandering of the continents across the ocean floor vitiates the idea of the permanence of ocean basins.

12. Pedological Observations on Soils of Darjeeling District.

N. R. KAR, Calcutta.

The paper embodies some of the results of investigations on the soils of the Darjeeling district carried out by the author during the last summer.

The petrological differentiation of the area, as manifested in the Siwalik sedimentaries, Daling clays and Darjeeling gneisses has no appreciable effect on the general character of the soil. The guiding factors in the genesis of the soil of the area are the topographic features and the climatic conditions—a humid micro-thermal monsoonic climate with an annual precipitation concentration of over the whole region, often being skeletal in the steep hill sides and bare rocks near the perched peaks. The soil distribution seems to be mainly governed by the topographic gradient and natural vegetative cover.

Profile studies in the Terai foothills, and in the Kurseong, Darjeeling, Takdah, Kalimpong hills indicate that the area is under a typically zonal soil—acid gray-brown earth, formed *in situ*, showing a thin, organically rich, black surface layer (A) overlying a thick, often 3-5 ft., fine sandy loam horizon (B), uniformly coloured gray-brown, red or chocolate resting on the bedrock (C). The average clay-content of the soil is about 30 p.c., followed by fine silt, silt and sand. The clay-content varies from place to place in these extremely uneven hill ranges and appears to bear a positive correlation with the precipitation. The reaction is mainly on the acidic side, the PH value on an average being 5.2 and the soil is comparatively rich in organic matter, nitrogen, phosphoric acid, potash and lime. There is evidence of little acid hydrolysis in the soil with consequent high content of exchangeable calcium, uniform distribution of sesquioxides with no widespread eluviation and no strong decomposition of silicates in the B horizon. This acid hydrolysis increases towards the north till near cool temperate Sikkim podzolised grey-brown earths are to be seen, and it decreases gradually southwards till on the foothills near the plains laterised red-earth make their conspicuous appearance.

13. Some Problems of Snow Survey in Eastern Himalayas.

BIKASH BASU, Calcutta.

Snow Survey helps to determine the relative amount of run-off contributed by snow-melt at various stages during the months of March-April-May by calculating the water equivalent of snow cover which will melt at those successive stages. This forecasting of run-off from snow-melt is an essential factor in the successful development of the multi-purpose schemes concerning river basins.

The amount of water that may be contributed by the melting of snow cover to the discharge of the streams in the months of March to May will be determined by the total accumulation of snow cover prior to the melt-season below the permanent snow line and the total area of the snow covered zone within the catchment basin. In the Eastern Himalayas the summer Snowline, that is the line above which the ground retains its snow cover in summer, lies somewhere above 18,000 ft. But I would prefer to call the zone between 18,000 ft. and 22,000 ft., the Glacial Melt Zone and that above 22,000 ft., the Glacial Evaporation Zone. Below 18,000 ft. the winter snow landscape may be divided into two major zones. The upper one lying between 18,000 ft. and 13,000 ft. may be called the zone of Winter Snow Cover. Below 13,000 ft. and up to an altitudinal limit varying between 10,500 ft. and 7,500 ft. there lies a Zone of Unstable Winter Snow Cover. In the Eastern Himalayas the bulk of the snow fall comes in the S. W. Monsoon season and this snowfall occurs in the Glacial Zone above 18,000 ft. Naturally the melt-water contribution in the streams from this zone is not very great. The winter snow-fall is primarily limited to lower elevations and comes during the passage of depressions. As the characteristic airmass in this season is NPc, which contains the lowest amount of initial moisture content of all the seasonal air masses in this part of India, the snow fall is usually very light and spotted in character. Moreover, after the snow fall comes the bright sunny spells and the snow cover usually disappears from the ground. So there is no opportunity to measure the accumulated snow in March or April and help in forecasting the discharge in streams during the critical months of March to May. These and certain other conditions in the Eastern Himalayas, discussed at length in this paper, seem to defeat the purpose of Snow Survey.

SECTION OF PHYSICS

PRESIDENT : DR. L. A. RAMDAS, M.B.E., M.A., Ph.D., F.A.Sc., F.N.A.Sc.,
F.N.I.

Atomic, Nuclear Physics

1. Generation of Mesons and its dependence on Meson spin.

S. K. CHAKRABARTY, Bombay.

Mesons obtained at sea-level are produced within the atmosphere but doubt exists regarding the primary which produces these mesons and also the process through which they are generated. Several hypotheses have been postulated of which the theory for the production of mesons by proton-nucleon collisions seems to be more reasonable. On this theory a proton by colliding with a nucleon will generate mesons as well as recoil nucleons and will also lose energy by ionization. In the present paper approximate expressions for the cross sections for different processes have been obtained both for a *transverse* as well as a *pseudoscalar* meson. These have later been used for the calculations of i) the energy spectrum of nucleons at different levels of the atmosphere ii) energy spectrum of mesons (both transverse and pseudoscalar separately) at different levels of the atmosphere produced by primary protons of different energies and iii) the integral spectrum of mesons at the different levels for an assumed energy spectrum levels of the atmosphere produced by primary protons of different energies and iii) the integral spectrum of mesons at the different levels for an assumed energy spectrum of primary protons incident at the top of the atmosphere. The energy spectrum of nucleons obtained here differs considerably from similar results obtained by Peng and the reasons for such differences have been explained. The energy spectrum of the mesons, whether transverse or pseudoscalar, produced by a primary proton are nearly similar except for the fact that the number of mesons on different energy regions is larger by a factor 2-3, if the mesons are transverse than if they are pseudoscalar. But this fact cannot be used to ascertain the spin of sea level mesons unless the intensity as well as the energy spectrum of the primary protons are accurately known. The energy spectrum however, depends critically on the proper life time of the meson at rest and comparison of the results of the present paper with the observed results of Wilson show that $\tau = 2.7 \times 10^{-6}$ sec. The observed $\cos^2 \theta$ of the latitude effect can however, be explained whether the mesons are transverse or pseudoscalar.

2. Nuclear Isomerism of Bromine 80 and the excited states of the Nucleus.

S. D. CHATTERJEE, Calcutta and N. K. SAHA, Delhi.

Earlier it was shown by one of the authors (N.K.S.) that the upper limit of the β -ray spectrum of the 18 min. and 4.4 hr. isomers of Br. 80 as obtained by slow neutron bombardment of bromine is the same within the limits of experimental error. In the present work (a) the same result is confirmed by a slightly improved method of measurement ; (b) the upper limit is also determined for the two periods excited by fast neutron bombardment. For the 18 min. period the upper limit is found to be ~ 2.26 Mev and that for the 4.4 hr. period ~ 2.02 Mev, practically the same as that under slow neutron bombardment ; (c) the excitation ratio of the two activities of 18 min. : 4.4 hr. period is studied as a function of the excitation energy of the bromine nucleus as obtained by

the bombardment of Br. by (i) slow neutrons, (ii) fast neutrons and (iii) a mixture of fast and slow neutrons. The excitation ratio in the three cases is found to be ~ 2.1 , 2.69 and 2.3 respectively with a probable error not exceeding ± 0.2 . Well known chemical methods of concentration of active Br. 80 in conjunction with G. M. —counters and mechanical recorders were used in these experiments.

In order to explain the observed variation of the upper limit of the β -ray spectrum and the excitation ratio of the isomers with the energy of excitation of the Br-nucleus, an energy level scheme of Br. 80 and Kr. 80 nuclei has been suggested. According to this a metastable state of ~ 48 KeV and an excited state of ~ 0.2 Mev above the ground state are attributed to the Br.80—nucleus, while an excited state ~ 0.5 MeV above the ground level of Kr80 appears to fit well with a γ —radiation of this energy observed by Snell associated with the 18 min. isomers of Br80 produced in the reaction Br79 (d,p) Br80.

For low excitation by slow neutrons only the 48 KeV metastable state of Br80 is excited, from which it returns to the ground state of Br80 by a (β -less) γ -emission and from there to the ground level of Kr80-nucleus. On the other hand for a large excitation by fast neutrons the 0.2 MeV excited state of Br80 is also excited in competition with the metastable state. This highly excited Br80-nucleus returns to its ground state by an "allowed" γ -emission and then passes on to the ground (or excited) level of Kr80 giving an 18 min. β -ray spectrum of the highest upper limit of ~ 2.2 MeV and the increased excitation ratio of 2.69 of the two activities of 18 min. : 4.4 hr. periods.

3. Neutron-Deuteron scattering.

C. K. SUNDARACHAR, Bangalore.

Neutron-deuteron scattering cross-section values deduced on the basis of current theories do not fit with experimental values, particularly at the lower energies. It may be that the interaction potential assumed in the theory is not correct or that there is an interference effect between potential and resonance scattering. An anomaly in neutron-deuteron scattering at 0.7 Mev. neutron energy has been noticed by the author. (*Nature*. 149. 51. 1942.). Similar anomalies have been noted by other workers in the scattering of low energy neutrons by the lighter elements. Results of a new experimental study of neutron-deuteron scattering, using a heavy paraffin as the scatterer, reveal resonances at the lower energies.

4. Characters of Cubic Groups.

T. VENKATARAYUDU and V. RAMAKRISHNAMURTY. Waltair.

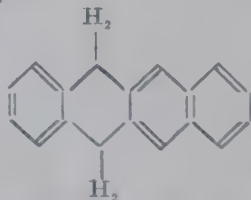
The point groups isomorphous to the cubic space groups are extended by taking the primitive translations T_x, T_y, T_z as distinct from identity but satisfying the relation $T_x^2 = T_y^2 = T_z^2 = E$. The characters in respect of such extended groups have been worked out.

Crystal Physics, X Rays and Crystal Structure, etc.

5. Crystallographic studies on 9 : 10 Dihydro-Naphthacene.

S. L. CHORGHADÉ, Nagpur.

9 : 10-Dihydro-naphthaceno,



crystallizes in the orthorhombic system. Good single crystals can be grown by slow evaporation of a solution of the substance in ethyl acetate. They appear as six-sided tabular plates parallel to (010) bounded by (101) and (120) faces, and clo-

gated along the 'c' axis. Occasionally, (110) and (001) faces are also developed. Since no pyramidal faces appear on the crystals so far examined goniometrically, morphological data do not enable us to decide whether they belong to the pyramidal or bipyramidal class of orthorhombic system.

From several sets of rotation and oscillation photographs taken about the three crystallographic axes with Cu.K_α radiation, it is found that the unit cell of the crystal has the dimensions

$$a=7.58, \quad b=25.77, \quad c=6.08 \text{ \AA},$$

and that it contains 4 molecules of $\text{C}_{18}\text{H}_{14}$.

Optically, the crystals exhibit strong negative birefringence. Preliminary measurements of the principal refractive indices of the crystal for the D lines of sodium gave

$$\alpha=1.60, \quad \beta=1.74, \quad \gamma=1.92,$$

$$a=\alpha, \quad b=\gamma, \quad c=\beta, \quad \text{and } V \approx 46^\circ.$$

The direction of vibration of the slowest ray and the long spacing of the crystal along the 'b' axis show that in the crystal of 9:10-dihydronaphthacene the molecular lengths lie along the 'b' axis. The direction of vibration of the fastest ray in the crystal and the 'a' and 'c' dimensions of the unit cell point to the conclusion that the normals to the planes of benzene rings in the molecule of 9:10-dihydronaphthacene make small angles with the 'a' axis of the crystal.

6. Isothermals for Rock-salt at high temperatures.

Dr. B. DAYAL. Benares.

The isothermals at various temperatures for rock-salt have been drawn theoretically. The static part of the pressure has been evaluated from the standard form of the potential function, while the calculations of the thermal part are based on Raman's theory of crystal vibrations. Compressibility and thermal expansion have been calculated from these curves and agree with the experimental values upto 900°K , the theoretical values increasing abnormally above this temperature. The pressure coefficient of compressibility has been calculated theoretically and is found to be in very good agreement with Bridgman's measurements.

7. Elastic frequencies of Amethyst and Smoky Quartz.

BR. KRISHNAMURTY, Waltair.

By the Ultrasonic method, using Debye and Sears phenomenon of the diffraction of light by Ultrasonic waves, the elastic frequencies of Amethyst and Smoky Quartz are determined with specimens of different depths of colour, and after complete decolourisation by heating at high temperatures. In both cases, the elastic frequencies differ from those of colourless quartz. They, however, show no correlative variation with depth of colour, and are not altered after decolourisation. Specimens from very thickly coloured portions of a crystal of Amethyst do not oscillate piezoelectrically.

Electricity and Magnetism

8. Magnetic susceptibilities of Alkaline Halides.

P. D. PATHAK and D. V. GOGATE, Baroda.

A precision method which is a modified form of Gouy's method was developed in this laboratory for the measurement of magnetic susceptibilities and it was used for determining the susceptibilities of Sodium, Potassium and Lithium halides. The object of this investigation was to examine (a) the validity of the law of additivity in the case of the above salts, and (b) the discrepancies between the observed and calculated values of their susceptibilities. This is probably the first attempt to determine the magnetic susceptibility of Li I in anhydrous form. It is found that the law of additivity holds to a first approximation in case of sodium and potassium halides but breaks down completely in the case of Li salts. It is suggested that the observed progressive increase in the differences between the calculated and observed values as we pass from Li-Cl to Li-I may be due to the interaction between the outer shells of the small positive ion and the heavier and powerfully charged negative ions.

9. The magnetic properties of Ferrous Sulphate Heptahydrate from room temperature to 80°K.

BHAGAWATI CHARAN GUHA, Calcutta

The temperature variation of the principal magnetic susceptibilities of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, shows that there is an essential similarity between this crystal and the ionic cobalt salts regarding their magnetic properties. The anisotropies in the two cases are nearly of the same magnitude and increase about seven times from room temperature to 80°K. The square of the mean magnetic moments is lower than the theoretical value for the free ion, by the same amount as in cobalt salts, and it decreases with fall of temperature in the same manner. The reason for all these findings should be attributed to the fact that the lowermost level of the Stark pattern in a cubic field in both Fe^{++} and Co^{++} ions is a triplet.

There is an axis of magnetic symmetry in $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, though the crystal structure does not lead to it.

10. Dielectric constants of Marbles and Limestones.

D. A. A. S. NARAYANA RAO, Waltair.

The dielectric constants of white marble of Jubbalpore, grey marble of Hyderabad, pink marble of Rajaputana, Kurnool limestone, Bhima limestone and Planad limestone are determined in the dry condition at a frequency of 1.6 mega cycles by a liquid mixture method. Sections in different directions of the same specimen are taken. The values are ranging between 7.7 and 8.6. Differences between the different coloured marbles are not as high as reported by previous observers. The dielectric anisotropy was found to be very slight, and no definite conclusions could be drawn from it.

11. A note on the equivalence of the Riesz method and the λ -Limiting process.

F. C. AULUCK, Delhi.

In the framework of the classical electromagnetic theory divergence-free results can be obtained either by the λ -limiting process due to Wentzel, Dirac, and Pauli or by using the powerful method due to Riesz where the potential is obtained by analytical continuation to $\alpha=0$ of an arbitrary parameter α . Recently Ma has established the equivalence, in the case of the field of a point source, of the λ -limiting process and the Riesz method. In this paper the above equivalence is established by an alternative method. In the case of the electromagnetic field we define the potential A_{ret} at the (space-time) point x_μ as

$$A_{\text{ret}}(x_\mu) = \frac{1}{2i\pi} \int_C \frac{S}{K} \frac{dR}{R},$$

where R is the hyperbolic distance between x_μ and a point $z_\mu(\tau)$ on the world line of the point source (τ denote proper time) ;

$$R^2 = [x_\mu - z_\mu(\tau)] [x^\mu - z^\mu(\tau)]$$

$$K(\tau) = [x_\mu - z_\mu(\tau)] \frac{dz^\mu}{d\tau}$$

C represents a suitable contour in the R -plane enclosing only the point $R=0$ corresponding to the retarded value of τ ($\tau=\tau_1$).

Electronics and Ionics

12. Ratings of low Power Rectifiers.

S. V. CHANDRASHEKHAR AIYA and C. S. SHIVARAM, Poona.

For the supply of d.c. from a.c., a power supply unit employing a rectifier is generally used. The physicist generally employs low power rectifiers but his requirements of constancy of supply voltage are much greater. Generally the performance characteristics are given by the manufacturers by a set of curves, voltage against current. Recent work has led to the conclusion that certain additional parameters have to be supplied. It is shown in this paper that a more important quantity, the R_p of the tube for different filament voltages is also necessary.

13. Influence of Temperature on Joshi-Effect in Oxygen.

S. R. MOHANTY, Benares.

Joshi-effect Δi in oxygen enclosed in a sealed Siemens' tube at 331 mm (32°C) has been studied at different temperatures t in the range 30-125°C. The gas was excited at various V increased over 2.5 KV of 50 cycles frequency. The A.C. indicator was a vacuo-junction.

At constant V , the discharge current i increases markedly with t . Thus, at $t=33^\circ$ and 125°C, iD in dark due to 2.67 KV was respectively 4.00 and 10.35. The 'threshold potential' V_m and also the net effect Δi increase with t up to 50°C and then decrease. Thus e.g. V_m was 2.31 KV at 33°C, rose to 2.37 KV at 50°C, and decrease with further rise in t to 2.19KV at 125°C. The variation with t of electrical breakdown of solid dielectrics in similar (Hippel, *Trans. Faraday Soc.*, 1946, 42A, 78). At the above V , Δi increased from 1.17 at 33°C to a maximum of 1.26 at 50°C, and decreased at higher t to 0.50 at 125°C. The relative effect % Δi , however, decreases regularly with t . It was, at the above V 29 at 33°C and 5 at 125°C.

Joshi (*Phys. Sec.*, Abst.26, 1946; *Cur. Sci.*, 1946,15,281; 1947,16,19) has suggested the formation of an electrode layer as primary to Δi . Since temperature would decondition the electrode layer, a decrease of Δi may be expected.

14. Influence of Light-Intensity on the Joshi-Effect in Chlorine under Silent Discharge at Various Gas Pressures and Exciting Potentials.

B. KAMESWAR SARMA, Benares,

Using 6H6 (R.C.A.) double diode as A.C. indicator, the dependence on the above factors of the *Joshi-effect* Δi is investigated in the range, the potential V , 1 to 10 KV; the gas pressure p , 5 to 300 mm Hg; and the relative light intensity I , 1 to 480.

The effect Δi increases with I more rapidly at small than at large I ; at the latter a saturation is perceptible. The Joshi-Lakshminarayanaiah equation, $\Delta i = aI^b$, where a and b are constants, was found applicable at low light intensities I . Furthermore the curves, $\log \Delta i - \log I$, tended to be linear at low exciting potentials V , in agreement with the above equation. At large V , the curves showed a concavity towards the intensity axis which has been generalized by Joshi as characteristic of this phenomenon.

The relative effect % Δi increases with p upto a maximum, decreases and then tends to increase again. Thus at 5, 20, 60, 100, 200, 300 mm Hg pressure, the maximum % Δi is 48, 50, 52, 38, 30, 37 respectively. The threshold potential V_m increases with p , from 1.2 KV at 5 mm to 7.7 KV at 300 mm. The net effect Δi increases with V ; the relative effect % Δi , however, decreases.

15. Influence on Joshi-Effect in Chlorine of the Inter-electrode Spacing in an Ozoniser Discharge at 50 and 500 Cycles Frequency

N. ATCHUTA RAMAIAH, Benares.

Joshi (*Indian Sci. Cong.*, *Phys. Sec.*, 26, 1946; *Curr. Sci.*, 1946, 15, 281) has ascribed the effect Δi *inter alia* to emission of photo-electrons from a boundary layer formed under the discharge. These electrons are captured by excited gas molecules

and atoms to form negative ions. Since the probability of electron capture depends upon p/E , where p is the gas pressure and E the field, *ceteris paribus*, Δi should decrease with E . Earlier, E at constant p was varied by altering the alied V . The dependence on E of the effect Δi is now studied by varying l the inter-electrode distance at constant p and V .

Three ozonisers A, B and C, of the same outer diameter and with d of 2, 4 and 6 mm respectively, were filled with purified chlorine at 500 mm pressure and excited at V varied in the range 2-14 KV of 50 cycles, and 0.5-6.0 KV of 500 cycles frequency. The 'threshold potential' V_m varied linearly with d . At constant V , both Δi and $\% \Delta i$ increased with d . Thus e.g. at 9.6 KV of 50 cycles Δi was 0.4 (A), 1.6 (B) and 2.3 (C); the corresponding $\% \Delta i$ was 21, 49 and 62 respectively. Results were similar at constant iD . Thus, with 500 cycles, at $iD=6.4$, $\% \Delta i$ for the above inter-electrode spacings was respectively 29, 34 and 39.

Increase of d at constant V reduces E , leading, on Joshi's theory (*loc. cit.*), to an increase of Δi , as observed.

In accord with Joshi's postulate of the formation of a boundary layer as fundamental to the effect Δi (*loc. cit.*), it was found that its magnitude in the freshly prepared ozonisers increased progressively with 'aging' under the discharge.

16. Comparative Studies of Joshi-Effect in Chlorine under Semi-ozoniser excitation at 50 and 500 cycles frequency

D. V. RAMANA RAO, Benares.

Previous work on this phenomenon, Δi , refers chiefly to Siemens' tubes as the excited system (Joshi, Pres. Add., Chem. Sec., *Indian Sci. Cong.*, 1943; Joshi and Deo *Nature*, 1944, 153, 434) This has now been extended to a semi-ozoniser discharge. The influence of the following parameters has been studied at both the frequencies mentioned above: the applied potential was varied from 1.0 to 5.0 KV at 50 cycles and from 0.2 to 1.0 KV at 500 cycles frequency; the gas pressure from 5 to 400 mm and the relative intensity of light from 1 to 530. The detector was a diode 6H6 (RCA inductively coupled with the L.T. of the discharge tube.

In this pressure range, for both the frequencies, the threshold potential, V_m , is sensibly a linear function of p . At a given p , the net effect Δi increases with V to a constant maximum. The relative effect $\% \Delta i$ ($100 \Delta i/iD$), however is a maximum near V_m and decreases thereafter. Thus e. g., at 100mm pressure, Δi increases from 1.1 at 1.6 KV to 6.5 at 4.05 KV; the corresponding $\% \Delta i$ is 52 and 40 respectively. At a constant V , viz., 2.94 KV, Δi increases from 2.7 at 5 mm to 6.0 at 40 mm pressure. Further increase of pressure to 300 mm reduces Δi to 1.1. The corresponding $\% \Delta i$ is 40, 53 and 26 respectively at the above pressures.

In agreement with the general findings of Joshi (*loc. cit.*) Δi and $\% \Delta i$ increases with increasing light intensity indicative of saturation.

Fundamentally similar results were obtained at 500 cycles frequency also. The, corresponding V_m was lower and usually, though not invariably, net Δi was greater at the larger frequency.

17. Influence of Capacitative Impedance and the Frequency Filters on the Joshi-Effect in Chlorine under Electrical Discharge

NARENDA NATH, Benares.

The marked influence of the above factor (in an unionised state) on the magnitude of the Joshi-effect Δi , a photo-variation of the discharge current i , in chlorine was observed by Joshi and co-workers (*Proc. Ind. Sci. Cong. Abst.* 23). In the present investigation the effect Δi is studied using neon and helium tubes of Geissler type. The capacities were connected in series with chlorine tube which excited at potentials 2.67 KV to 9.3 KV, at 50 cycles frequency, using a double diode as a rectifier. In the first group of results, when whole of the L. T. current was allowed to pass through the neon tube the glow appeared in it before the threshold potential V_m of the chlorine tube, the current was large but Δi was not detected before V_m . Remarkably enough, the H. F. part of i showed practically a 100 % of current decrease near V_m ; iL. F. showed 39% of current increase under light at low applied KV; and at higher KV this positive effect changed to negative. Next, helium tube was substituted for neon tube. i, the discharge current was greater and $\% \Delta i$ less for helium tube than in case of neon. Furthermore, Δi was negative near V_m , whereas 6 % of $+$ Δi was observed at higher

KV. At the above mentioned KV, iD , — Δi and the corresponding % Δi were quite large in H.F. i.L.F. did not produce any glow in the helium tube, and therefore did not show any current. These results and the previous ones show that the effect Δi is essentially the same irrespective of the nature of the external capacity and that the chief seat of Δi is the H.F. part of i .

18. Studies of the *Joshi-Effect* in Iodine with a Triode and a Pentode under Various Modes of Operation.

S. N. TEWARI, Benares.

It was observed by Joshi that the value of a capacitance in the path of the discharge current determines appreciably the magnitude of the corresponding light-effect. The role of an external capacitance has been investigated with a triode 37 coupled inductively. It was observed here that % Δi increased progressively with the decrease in the serial capacitance but it decreased markedly with the decrease in the parallel capacitance.

Results showed that % Δi was always higher under the anode bend than the grid leak detection and that pentode 6J7 showed greater % Δi than the triode. When the pentode and triode were coupled resistively the magnitudes of Δi and % Δi were greatly reduced and that an inversion of a negative *Joshi-effect* to an apparently positive-effect occurred beyond a certain critical value of the resistance. In the case of the triode the grid current, however, invariably decreased on irradiation but in the case of the pentode, the grid current, and any changes therein on irradiation could not be observed. The most important aspect of the positive-effect was that it often started with a negative kick, was slowly built up and instantaneously destroyed on shutting out the irradiation. In the case of triode the positive-effect may be accounted for (i) saturation due to R.F. part of the signal, (ii) grid-shift towards positive on irradiation.

A shift of the grid bias to higher negative value increases % Δi and the positive-effect is shifted to higher exciting potentials.

19. Production of *Joshi-Effect* in Oxygen in Semi-ozonisers.

S. R. MOHANTY and P. C. PRADHAN, Benares

Joshi-effect has been studied in oxygen filled at different pressures in the range 50-500 mm in semi-ozonisers, the central high tension wire being gold, silver, and copper under comparative conditions. The exciting potential V was varied over 0.5-5.0 KV of 50 cycles frequency. The detector was a diode 6H6 used as a half wave rectifier; it was coupled inductively with the L.T. of the oxygen tubes. No effect was observed below V_m , the potential necessary to initiate a discharge. Above V_m , i increased with V ; the relative effect % Δi , i.e., $100 \Delta i / iD$, however, was maximum at V_m and decreased with V . Thus e.g. at 50mm with a semi-ozoniser containing a H.T. wire of gold, Δi increased from 0.4 at 0.67KV to 1.5 at 4.67 KV; the corresponding % Δi was respectively 33 and 12.

At constant iD , the effect varied in the order gold > silver > copper. Thus e.g. at the above pressure and $iD=6$, % Δi was 14 (gold), 5 (silver), and 2 (copper). This difference has been traced to the catalytic activity of the metals concerned. The effect has also been studied at 500 cycles frequency.

Light

20. Passage of Visible Light Through Cloud and Fogs

Y. G. NAIK, Ahmedabad.

When a beam of light passes through a fog, the portion of beam intercepted by the particles in the cloud is scattered by them in all directions. The amount of light scattered in different directions depends on the size and the refractive index of the drops. This problem was first investigated theoretically by Rayleigh and Love for particles, smaller than or equal to the wave length of light and having small refractive index. Mie developed a general theory applicable to any size and any refractive index.

The present paper deals with three important aspects of the passage of light through artificial fogs, which approximate to the natural conditions in the atmosphere.

(i) It has been shown that the Mie's theory explains not only the formation of corona rings but also the scheme of coloration of the Central Corona disc, which the previous theories due to Verdet, Airy and others failed to explain.

(ii) The problem of light transmission, which gave very conflicting experimental evidence from different investigators, has been explained satisfactorily with special reference to the part played by the size and the number of drops scattering the light. The minimum wave length of light, corresponding to a given size of particles in a fog or cloud which gives a transmission of light without undue fluctuation of light intensity, has been determined.

(iii) The phenomenon of the Brocken bow or the glory has been satisfactorily explained on the basis of the calculations of the Mie's theory of light.

21. Studies in Colloid optics

P. K. KATTI, Poona.

The phenomenon of the sol-gel and gel-sol transformation for various concentrations of agar-agar has been studied by the colloid-optical technique of R. S. Krishnan. The depolarisation values P_u , P_v , & P_H have been measured in the temperature range of 80°-20°C by using a pair of double image prisms in the usual manner.

The intensity variations have been measured for the above temperature ranges. Values of P_u calculated and observed agree throughout the range verifying the Krishnan

relation $V_H = H_v$ and
$$P_u = \frac{1 + \frac{1}{P_H}}{1 + \frac{1}{P_v}}$$
 for all concentrations.

At all concentrations the critical temperature below which the intensity of the scattered beam increases is 35°C. The decrease of P_H and P_v starts at 33°C. For the gel to sol transformation in warming the gel from 20° to 80°C there are no sudden changes at 33° or 35°C, but the polarisations and intensities change over gradually to the original 'sol' values of 80°C.

Meteorology, Geophysics, Oceanography etc.

(a) Atmospheric Physics

22. Height distribution of Atmospheric ozone at Delhi.

R. V. KARANDIKAR and K. R. RAMANATHAN, New Delhi.

Observations of the zenith scattered light made with Dobson's photo-electric spectrophotometer on clear days at Delhi (Lat. 28° 35'N) during the period November 1945 to March 1947 have been used to determine the vertical distribution of ozone at this place.

Dobson's method A was used to get an approximate idea of the height distribution and this was used as a starting point for the more elaborate method B. Only primary scattering was taken into account, but scattering from layers right up to 100 Km. was considered.

The height distribution of ozone has been calculated, for days with total ozone amounts varying from 0.155 cm. to 0.217 cm. and curves of distribution drawn. A decrease in the total ozone amount is found to cause a rise in the centre of gravity. The centre of gravity was found to be 26.5 Km. for 0.155 cm. as compared to 25.0 Km. for 0.217 cm. For the same ozone amount, the height of the centre of gravity lowers as we go to higher latitudes, e.g. for the ozone amount 0.217 cm the height is 25 Km. at Delhi 22.5 at Arosa and 21 Km. at Troms.

Following a hailstorm in the first week of May 1947 at Simla, a marked lowering of the centre of gravity of the ozone layer was observed.

In calculating the distribution, it was found that while the observed values of the intensity of zenith scattered light could be fitted with the calculated values sufficiently well in the range $Z = 90^\circ - 60^\circ$, there were increasing differences as Z approached zero. An attempt has been made to analyse this and it appears that the discrepancy is due to scattering by large particles which are always present even in apparently clear skies.

over Delhi. The effect of scattering by large particles is large at small angular distances from the sun and becomes much less at greater distances. Better agreement can therefore be expected for larger values of Z .

23. Effect of dust and haze on the spectral distribution of zenith-scattered radiation.

R. V. KARANDIKAR, New Delhi.

Observations of the light scattered from the zenith sky made with Dobson's photo-electric spectrophotometer at Jaekko, Simla, in April and May, 1947, showed that there were certain wellmarked differences in the values of the intensity-ratios I''/I' and I'/I as measured on clear and hazy days. Here I , I' , I'' are the intensities of the three wavelengths λ (3110Å), λ (3300Å) and λ'' (4450Å) respectively, being strongly absorbed by the atmospheric ozone, only slightly and λ'' not at all. When $\log I''/I'$ and $\log I'/I$ were plotted against the zenith distance z of the sun, for the same value of z these were found to be markedly higher on hazy days than on clear days. Simple consideration shows that this is expected.

It was further noticed that, after a rapid decrease in the range $z=90^\circ$ to 60° , $\log I''/I'$ decreased less and less rapidly below 60° , showed a minimum near about 45° and further began to increase, the rise being rapid beyond 20° . Calculations of primary molecular scattering showed that the expected curve should steadily decrease with z . These deviations from the calculated curve become less marked on days with less haziness, but still persisted even for apparently very clear skies. $\log I'/I$ also showed similar deviations, but these were less marked and occurred only in the region of low values of z .

This peculiarity of the variations of zenith sky light for small zenith distances of the sun could not naturally be observed in middle and high latitudes and does not appear to have been commented on.

A study of the phenomenon shows that the deviations have their origin in large-particle scattering in the atmosphere in the forward direction and shows itself conspicuously by the presence of an 'aureole' round the sun. The more marked deviations in the case of $\log I''/I'$ provide a means to determine the amount of dust and possibly its height-distribution in the atmosphere.

24. An instrument for the measurement of Infra-red radiation from the atmosphere during day as well as night.

R. S. KALE, Poona.

An instrument for the measurement of atmospheric infra-red radiation is constructed. It consists of two pairs of polished aluminium strips. One pair is blackened and afterwards coated with magnesium oxide. The two pairs are mounted alternately on a horizontal "tuffnel" plate, so as to be exposed to the whole hemisphere. Copper-constantan thermo-junctions are fixed to each of the strips in series and a galvanometer placed in the circuit gives the effective radiation to the atmosphere. Magnesium-oxide has got the reflecting power of 90% in the visible region, but behaves as a black body in the infra-red beyond 4μ . This is exactly the starting point of atmospheric radiation. Aluminium has a reflecting power of 75 to 80% in the visible region and above 90% in the infra-red region. So the MgO coated strips exchange radiation with the atmosphere and are thus cooled while the other pair remains at the temperature of the surrounding air (T). The MgO coated strip can be brought to the same temperature as that of the other pair by passing an electric current through them. From a knowledge on the compensating current (I), and the instrumental constant (K)—known after the calibration of the instrument—the incoming atmospheric radiation (S) can be calculated from the formula,

$$S \equiv \sigma T^4 - KI^2$$

where σ is the Stefan-Boltzmann constant.

This instrument can be used with equal facility during day as well as night.

25. Variation of Electronic Density in the Ionosphere with Latitude.

S. S. BANERJEE and R. N. SINGH, Benares.

Study has been made of the variation of electronic density in the F2-region of the ionosphere over Indian latitudes within the region of longitudes 70° and 90° East. For the above purpose, mean monthly electronic densities at noon have been calcu-

lated from the ionospheric data recorded at Peshawar, Delhi, Bombay and Madras by the Research Department, All India Radio. It has been shown that the observations clearly indicate the lowering of noon-ionization of the F2—region near about the magnetic equator throughout the year, due to geomagnetic control of the ionosphere as suggested by Sir Edward Appleton (Nature, 157, 691, 1946) and subsequently explained by Professor S.K. Mitra (Nature, 158, 668, 1946). It has been further observed that due to the above lowering of ionic density there appears to be a region of maximum ionization around the latitude of 20° north, and the rate of lowering of electronic density towards the equatorial side increases during the equinoxes. This has been explained to be pre-as suggested by Sir Edward Appleton (Nature, 157, 691, 1946) and subsequently explained by Professor S. K. Mitra (Nature, 158, 668, 1946). It has been further observed that due to the above lowering of ionic density there appears to be a region of maximum ionization around the latitude of 20° north, and the rate of lowering of electronic density towards the equatorial side increases during the equinoxes. This has been explained to be presumably due to thermal expansion of the ionized layers over the equator caused by high temperature in that region with parabolic distribution of ionization. Following Chapman's theory of variation of ionic densities with latitude, an estimate has been made of the lowering of electronic density due to an assumed increase of temperature over the equatorial region of the ionosphere. The effect of temperature on the ionization of F2—region is further indicated by the reversal of ratio of concentration of electrons between the equinoctial months and winter solstice in the neighbourhood of latitude 25° north.

26. Studies of ionospheric disturbances associated with terrestrial-magnetic, radio and solar effects.

M. V. SIVARAMAKRISHNAN, Poona.

The paper presents an account of some magnetic disturbances associated with solar flares and radio fade outs during the period 1937-1946. The ionospheric irregularities associated with four great magnetic storms recorded at the Magnetic Observatory, Alibag (Bombay) are discussed. The approximate travel time of the solar stream of corpuscles from the Sun to the Earth is calculated. An intense flare is followed about a day later by a great magnetic storm far more often than could occur by chance. The presence of a "Crochet" in the magnetic records occurring simultaneously with the appearance of a solar eruption or flare suggests that there is a radiation from the sun travelling with the speed of light, while the magnetic storm which appears between 18 and 30 hours later seems to be caused by a corpuscular radiation with particles travelling at a speed of 1,000 to 2,000 miles per second. From the simultaneous radio fade out, in which the total cessation of the ionospheric reflection of short radio wave occurs, a great increase in the ultra-violet emission for the sun is deduced.

An attempt is made to collect a list of sudden ionospheric disturbances of the type from observations made in India for the period 1937-1946.

27. Reflection of Atmospherics from the Ionosphere at night.

M. W. CHIPLONKAR and M. S. HATTIANGDI, Poona.

This paper gives further results of investigation on the atmospherics at night carried out during the period March 1944 to November 1945 at Poona. Over 600 photographic records have been obtained and analysed here. The interpretation of these records on the multiple reflection theory of simple atmospherics pulses gives a mean ionospheric height of 91.3 Kms. at Poona. (Lat. 19° N and Long. 73° E). Also there are two other distinct levels viz. about 130 Kms. and 45 Kms. from which reflections are found to occur at times. Distances of the origin of atmospherics have been calculated for over 300 atmospherics. They range from a few Kms. (local ones) to over 3000 Kms. Reflection coefficients calculated from the decay of amplitude of the reflected pulses lie between 0.72 and 0.51 and compare well with those found by others at other places. The total number of reflections observed on most of the occasions varied from 10 to 25 the maximum being 42. The field strength at the place of observation varied from about 0.1 millivolt to a fraction of a volt. With a view to find a relation between nature of the high frequency precursors which precede the ground pulse and the different characteristics of the ground and sky-pulses some typical records have been carefully scrutinised and the results obtained are discussed in the light of the discharge mechanism of a lightning stroke.

A number of records also show wave forms of atmospherics which cannot be interpreted on the above mentioned reflection theory.

28. A Statistical study of the conditions of beam wireless communication between India and England in relation to solar and geomagnetic phenomena.

M. W. CHIPLONKAR and Y. R. NENE, Poona.

This paper describes and discusses briefly the preliminary results of statistical analysis of the conditions of beam wireless communication between Grimsby (England) and Poona (India), during the period (1930-1943). For this purpose the usual method of assigning character figures is adopted. The Time-Patterns and the march of the mean annual character figures show the 11-year period clearly. The monthly character figures give an annual variation which shows a double periodicity. It is pointed out here that a similar double periodicity was observed by one of the authors in the measurements of the total amount of atmospheric ozone during (1936-1938) at Bombay. The 27-day recurrence tendency is clearly brought out both in the Time-Patterns and the Chree recurrence diagrams which were drawn here with 87 days following and preceding the selected days of high character figure. The frequency of high and low character figures for each of these days also shows this in a novel and striking manner. With a view to studying the conditions of commerciability between India and England in greater detail the daily character figures have been divided further into day-and-night character figures, the day representing the normal period of reliable communication on wavelength 34.17 m. and the night that on wavelength 16.22 m. In general, the conditions were more favourable during the night than during the day; and the absence of 27-day recurrence tendency in the night figures points to the conclusion that the wave radiation from the sun was responsible for most of the observed unfavourable conditions. Further results are discussed in relation to those obtained by others previously for the transatlantic communication. A close parallelism is observed between all the above variations of conditions of communications and the geomagnetic variations over the same period.

29. "Barisal Guns" and the upper atmosphere.

M. W. CHIPLONKAR, Poona.

Attention is drawn to an old publication of (1888) entitled "Memorandum on the Barisal Guns" other similar papers which give a good deal of information on the nature and distribution in time and space of the loud sounds well known in the North East India since long as "Barisal Guns". From the existence of the alternate zones of audibility and inaudibility, the direction of sound waves etc. it is inferred that the place of origin of these sound waves lies in the so called "Swash of no ground" in the Bay of Bengal. On the basis of the excursions of sound waves through the upper atmosphere and the dependence of the velocity of sound on temperature an approximate distribution of temperature with height in the stratosphere over the tropics is deduced and compared with those obtained similarly by others in the temperate latitudes. A point of great significance is the steep rise of temperature (from about 220° A at 35-40 Km level to about 350° A at 55-60 Km level) in the ozonosphere deduced here. This therefore furnishes a reliable data which gives for the first time a distribution of temperature at such high levels over the tropics.

(b) Radiosonde and other Meteorological Instruments

30. The calibration Equipment for the F type Radiosonde

S. P. VENKITESHWARAN, Poona.

The paper describes the details of construction of the calibration equipment for the F Type Radiometeorograph using carbon dioxide snow for lowering the temperature. It also describes the calibration equipment for use with a Deep Freeze cabinet imported from America. The method of correcting the readings of the thermometer for emergent column is explained. Details are also given for correcting the readings of the manometer for temperature, variation of the level of mercury in the cistern, and the pressure due to trichloro-ethylene in which the meteorograph is immersed.

31. A portable ground equipment for the F type Radiosonde

S. P. VENKITESHWARAN, A. KESAVAMORTHY, B. B. HUDDAR and
B. K. GUPTA, Poona.

The paper describes the modifications made in the present ground equipment to make it portable and easier to operate. The aerial is capable of being mounted on

a tripod stand used with pilot balloon theodolites. The recording arrangement consisting of a moving paper tape and an electro-magnet operating an ink fed nib is replaced by a Cenco high frequency impulse counter. By adopting this arrangement, the time marking device on the paper tape is dispensed with and replaced by an ordinary stop watch. The possibility of simplifying the calibration equipment to calibrate and let off meteorographs with which data can be obtained upto 20,000 ft. at a low cost from a number of stations is also described.

32. Some improvements in the F type Radiometeorograph and an investigation of the performance of the instrument.

S. P. VENKITESHWARAN, V. KALYANSUNDARAM and A. P. JAYARAJAN,
Poona.

In all types of radiometeorographs where the meteorological element is measured by the movement of an arm acting as a switch in the wireless transmitter, there is an unknown error due to the friction of the pens. This error due to friction was present in the F type radiometeorographs also ; but this was eliminated by cutting a groove about $\frac{1}{4}$ " wide and $\frac{1}{3}$ " deep just in front of the silver spiral. A simple arrangement was rigged up to seal the aneroids used in the meteorographs under any required exhaustion. Ascents were made on a number of days with two instruments with signalus of different wave lengths attached to the same balloon and followed with two independent receivers and recorders. Different types of meteorographs were released and the agreement between the data examined. The paper discusses the degree of agreement between the data obtained with the two instruments.

33. Distant reading instruments for measuring surface winds.

A. KESAVAMORTHY and S. P. VENKITESHWARAN, Poona.

With the increase in aviation, the requisitions for meteorological reports from aerodromes have also increased appreciably. The data have to be supplied both for the planes in the air and on the ground with the least possible delay. Different types of instruments have been constructed to measure the velocity and direction of surface wind from the room of the observer without going up to the anemometer or wind vane which are usually located in places not easily accessible. The present paper describes an equipment consisting of an electronic wind speed indicator and a wind vane using selsyn motors. In the electronic wind speed indicator, an r.f. voltage with a frequency of 30 Kcs generated in the observer's room is fed through a pair of cables into a coil fixed in the box carrying the spindle of the 4-cup anemometer. Another coil is fixed just below the first coil and the voltage induced in this is fed into an amplifier through a pair of shielded cables. A brass circular vane with ten sectors fixed on the anemometer spindle and rotating in the space between the two coils makes the induced voltage fluctuate at a frequency which is proportional to the rate of rotation of the anemometer cups. The induced voltage is amplified and the varying portion of the voltage further amplified and converted into square wave pulses of constant amplitude and then fed into a frequency discrimination circuit which indicates the frequency of the voltage variation by means of a micro-ammeter calibrated in miles per hour. The paper also describes the advantages of this method over some of the other methods in use.

34. A Further report on the cathode ray tube spectrograph

A. U. MOMIN, Poona.

The Cathode Ray Tube Spectrograph has already been described briefly in earlier communications to the Indian Science Congress (1947), to Nature (26 July 1947) and to the Symposium on "Atmospheric Processes" of the National Institute of Sciences of India (1946). In this paper some further development and refinements which enable the instrument to be used for quantitative measurements of the emission and absorption spectra of the sun and laboratory sources like the sodium and mercury arcs, Pointolites and the spectral absorption of glass filter and dyes, are given.

A new scanning mechanism is described which converts the rotary motion of a wheel into simple harmonic motion which is communicated to the scanning slit. The movement of the slit itself is utilized for generating a sinusoidal e.m.f. which is automatically synchronized and applied to the horizontal plates of the cathode ray tube. This new feature enables the time base to be 'locked' with the oscillations of the slit and the image on the cathode ray tube remains steady and unaffected by any drift in the rate of rotations of the driving motor.

Another new feature of the instrument is the use of a pre-amplifier for the photoelectric cell, which has now made it possible to study much weaker spectra produced by laboratory sources. Some typical photographs of the emission spectra of mercury and sodium and the absorption spectra due to atmospheric water vapour and oxygen, in the near infra red region of solar radiation, and spectral absorption in filters and dyes are given.

The results so far obtained are very encouraging and there is no doubt that by using the recently developed multiplier photoelectric cell it will be possible to study extremely weak spectra and make intensity measurements almost instantaneously without resorting to the conventional photographic methods.

35. A comparison of the Catch of rainfall in Shielded and unshielded precipitation gauges.

SALARUDDIN and V. C. SARNA, Poona.

Comparison was made of the catches of 5" ordinary type unshielded raingauges and those fitted with a Brookes type of shield. One set of these instruments were exposed on the ground and the other on a tower about 119 ft. high. Observations of rainfall made during September and October 1947 showed that the average excess of catch in the shielded rain gauge over that of the unshielded one was about 2% on the ground and 8% on the tower. The average wind velocity during the period was 3 miles per hour on the ground and 8 miles per hour on the tower. Experiments were also conducted to find the excess of evaporation in the snow-gauges over that in the ordinary rain gauges which are provided with funnels and narrow necked receivers.

(c) Weather Forecasting, Weather Phenomena, etc.

36. Kiebel's Method of Weather Forecasting Directly Inapplicable to India.

S. L. MALURKAR, Poona 5.

Kiebel gave a quantitative method of forecasting in Russia and got the Stalin Prize for it. Last year, the workers at Massachusetts Institute of Technology found that this method did not offer any advantages over previously known methods. A preliminary examination of its applicability to the Tropics is desirable.

The pace of progress in Meteorology has, for the last generation, been set largely by the rapidly expanding needs of aviation. Inevitably, rule of thumb results serving the particular needs with a fair degree of accuracy had to be resorted to. The working equations in a logical development of the subject depend, ultimately, on facts observed in certain areas or conditions. When those conditions do not reproduce themselves in other latitudes, the equations and the rule of thumb results break down. An early work by the author and Ramdas showed that the lapse-rates of temperature very near the ground in the tropics were much larger than the values accepted in text-books and recent work elsewhere. The large values could be accounted for by a fresh investigation.

In weather forecasting, the differences are greater. In the temperate zone, depressions have an eastward motion. The tropical depressions have a west-ward motion. The secondary depression in the temperate latitudes travels much faster than its primary. The author pointed out that the secondary low of a western disturbance travels slower than its primary in the peripheries of the tropical zone. This coupled with the paucity of observations over wide areas gave the apparent effect that disturbances travelled SE wards in the Persian Gulf and intensified a fact that has entered into climatic records. Attempts were mostly made to reduce all tropical weather into particular examples of extra-tropical weather. This led to avoidable confusion. The large number of workers with experience of weather mostly from the temperate latitudes could not do otherwise. A free India must develop Tropical Meteorology for its own needs and must examine carefully each assumption in the subject. 'Ad hoc' assumptions for each disjointed phenomenon retards progress. It must be made clear that the weather in the Tropics and elsewhere must be particular cases of the general circulation of the world; i.e. be expansions of functions about different points. Generalised principles are most useful.

The author gave one such principle recently. The direction of motion of a depression or a cyclonic storm is determined by the upper wind motion at about 6 Kms

in the sector corresponding to the "source" mass. The depressions are perturbations on the general circulations of the atmosphere. Due to the fluid structure, the exact boundaries of the perturbation are ill defined. Still general conclusions can be drawn from hydro-dynamics. The motion of the perturbation is being guided by a whole layer of fluid. The wind at 6 Km gives an average value of what is happening in this directive layer. If one takes the vertical height of the depression is about 4 Kms, it would affect up to and be reciprocally be affected by the layers up to 8 Kms. The mean motion at 6 Km may then give the forward motion of the depression. In middle latitudes, the height of the troposphere is confined to about 7-10 Kms. A worker in the more northerly latitude would observe a considerable effect of the depression on the tropopause. The worker in a slightly lower latitude whose tropopause may be at about 10 Kms finds the tropopause as a quiescent layer. Even if other things were equal, a worker with a troposphere extending to 15-17 Kms finds little analogy with either.

But other things are not equal. The gradients of pressure and temperature in the tropics are much smaller than in the temperate zone even at the surface. The changes in the above quantities are small at the surface in most cases of disturbed weather, and necessarily smaller at higher levels of the atmosphere. With our instruments, the changes may not be definitely detectable at heights of 8-10 Kms and certainly not at 15-17 Kms.

The convective layer in a depression seems to be of nearly the same order in the tropics and in the temperate zone. The deeper thickness of the tropical troposphere is due to long period convection and radiative equilibrium. The small variations due to depressions can hardly be expected to penetrate to the tropopause.

Kiebel's theory depends essentially on the fundamental assumption that the tropopause continues to have the same individual elements with the passage of a depression. The tropopause is a *definite* boundary just like the ground and depression was assumed to affect only the intervening layers. In the tropics, nearly half the height of the troposphere is apparently unaffected by passing depressions. As such Kiebel's theory cannot find application to the Tropics without serious modification.

Before a satisfactory modification can be thought out, one should know all the facts in the upper atmosphere of the tropics. This poses new problems. Instruments with much smaller corrections and reliability, which can operate at greater heights than in the temperate zone are required. The theoretical worker must find easily recognisable criteria which off set the smallness of the changes in the measured quantities. The author has tried to follow Equatorial-Maritime Air by the series of thunderstorms along its path on the land, squally seas and by the small diurnal variation of temperature, instead of basing the detection on purely the temperature and humidity. A number of other criteria have been given for other Tropical air masses.

37. Lower Level Winds Along the Deltas of the North Madras Coast

S. L. MALURKAR, Poona 5.

During the monsoon months, the winds in the overlapping deltaic region of the north Madras coast are stronger below 3000 ft than at corresponding levels at Madras or at Vizagpatam. This is shown to be a consequence of orography and the equation of continuity. The algebraic sum of the winds at Vizagpatam and Madras at those levels are of the same order but slightly larger than the winds at Masulipatam at the lower levels.

38. Effect of Afternoon Heat Lows on Winds at Lower Levels.

S. L. MALURKAR, Poona 5.

As a continuation of previous work on semi-stationary low pressure areas (Tech. Note no. 20. Ind. Met. Dept.), the places where afternoon low pressure areas can be expected are given. The resulting large diurnal variation of wind is shown to be related to these heat lows. The variation of winds at lower levels at Ahmedabad in winter, Mandalay in the non-monsoon months, the penetration of sea-breeze to the east of Western Ghats, and the westerly strong winds in the United Provinces on summer afternoons are all at least qualitatively explained. Till now there was not even such an explanation for the last two effects. The sea breeze penetrates over Gujarat not more than 15 to 20 miles, while it penetrated across the Western Ghats, a high range of hills of 2000-3000 ft height, to a distance of even 70 miles.

39. Study of convergence in the field of motion of the air, and its importance in forecasting the development and progress of nor' westers in Bengal.

A. K. Roy

The study of nor 'westers, the violent thundersqualls which spring up in northeast India, and more commonly in Bengal, during the pre-monsoon months, March to May, have for a number of years engaged the closest attention of Meteorologists in India, and a good amount of literature on the subject has already been published in the India Meteorological Department publications and other outside journals. While these investigations have given us a fairly good insight into the thermodynamical structure of the atmosphere which favours the growth of these storms, and enable us now to make a reasonably complete diagnostic study of their development and subsequent progress, the problem of forecasting and issuing timely warnings on all occasions about these storms, with the accuracy that is demanded by the public in general, the district authorities and engineers in charge of works still continues to baffle the earnest efforts on the part of even the most experienced forecasters.

The study of the airmass structure of the atmosphere associated with these thundersqualls shows clearly that the genesis of these thunderstorms lies in the incursion northwards, up to a height of some 5000 ft., of Tc air with sea travel (Tc Tm air mass) or occasionally of Tm air proper round the southern and eastern end of the trough of low over the Gangetic valley, this being overrun by dry air of purely continental type, the lapse rate in which is high and sometimes approaches the dry adiabatic value. Earlier investigations on the subject, and the examination of the day to day distribution of temperature and humidity, as given by radio-sonde observations show that a superposition of airmasses as above gives rise to a condition of 'latent instability' in the atmospheric structure which, under certain favourable conditions, leads ultimately to the violent overturning of the column of the atmosphere, resulting in the release of kinetic energy in the form of a squall. However, as we analyse the synoptic charts of a day on which the conditions are generally favourable for the occurrence of nor 'westers, we find that while the instability of this type prevails over a fairly wide area covered by the wedge of the moist and relatively cool air mass in the lower levels, and while from our experience and theoretical considerations we expect that the most favourable zone for development of the thundersqualls would be some fifty to hundred miles away from the line of discontinuity between the moist and dry air masses and on the moist air side of it, the main difficulty in forecasting accurately about these storms from the point of view of their exact location and time of occurrence is that the process of their development, which depends for its initiation on a certain kind of 'trigger action', starts at only some select points in this area, and that the origin and subsequent movement of the storms depends largely on the kinematics of the air movement up to a height of 10,000 ft. or more, over that locality. In a paper read by the author in the Symposium of "Atmospheric Processes", held in Bombay in 1946, under the auspices of the National Institute of Sciences in India, it was suggested that the thunderstorms of the pre-monsoon season are often the result of waves on a quasi-stationary discontinuity where the two main air masses of the season converge towards each other. This idea has been further developed as a result of the study of the synoptic charts of some of the important nor 'wester days of 1947, and it is seen that a "wave theory" of thunderstorms on a line analogous to the well-known "wave theory of cyclones of temperate latitudes", gives a helpful clue to the birth and subsequent life history of these more elusive local storms which also, in a way, reveal some of the characteristics of "miniature cyclones". Unlike the waves on the "polar front", on which develop the extra-tropical cyclones, the waves associated with these storms are of much shorter length, and are also decidedly more unstable. A prognostic study of the development of these waves, which is the result chiefly of convergence in the field of motion of air, and of the growth, orientation and subsequent of these waves requires a detailed and careful analysis of the kinematics of air movement up to a height of 5000 ft. or more, and also as good an estimate as possible of the probable changes thereof, taking into consideration the differential pressure tendencies over the area and the surrounding region during the next 6 to 12 hours.

40. Thundershowers at Madras in North-East Monsoon Season.

B. N. SREENIVASIAH and VENKATESWARA RAO

An analysis of soundings made prior to the occurrence of Northeast monsoon showers (which invariably occur in the early morning or forenoon) brings out a typical vertical structure of the atmosphere, in which a dry air layer (of relative humidity 40-

60%) is sandwiched in between moist layers below and above. The mechanism of these showers is traced to radiational cooling of the upper layers.

41. On Orographic Rain

P. R. PISHAROTY, Poona.

It is well known that the distribution of rainfall is most noticeably affected by mountain ranges. In weather situations like the southwest monsoon, the rainfall on a hilly coast like the Konkan coast of the Indian Peninsula is said to be purely orographic—that is, caused by the steady ascent of moisture laden air over the mountain barrier. The theoretically possible rainfall has been calculated under the following simplifying assumptions :—

- (i) that there is no appreciable change in the volume of air as it moves along the different parts of the same stream surface,
- (ii) that the scale of turbulence is small compared with the dimensions of the mountain, and
- (iii) that there is no penetrative convection.

The stream surfaces around an infinite circular cylinder, placed with its axis horizontal and embedded in a uniform horizontal field of flow, are given in standard text books on Hydrodynamics. By the conformal transformation

$$Z = \left(z - \frac{a^2}{z} \right)$$

the stream lines around a circular obstacle of radius a are transformed into those around a linear obstacle of length $4a$. One of these stream-lines in the Z plane, approximating to the profile of the actual mountain ridge, is selected and the space below this stream-line is considered as solid. The remaining stream-lines above this solid boundary are then taken to represent the field of flow across the mountain ridge, the wind flow being at right angles to the axis of the barrier.

The vertical velocities at every point in the free air, on the windward side of the mountain, associated with such a stream line pattern are calculated using the conformal transformation already referred to. Employing these vertical velocities, the maximum possible rainfall per day is calculated from the Fults formula :—

$$R = \frac{780 a p}{T} - \frac{2666 e}{T^2}$$

where R is the rate of precipitation of rain in millimetres per hour from a layer of saturated air 100 metres thick and having a vertical velocity of 1 metre per second,

a is the wet adiabatic lapse rate in deg.C per 100 metres,

b is $\frac{de}{dT}$ in millibars per deg.C,

T is the absolute temperature, and

e is the saturation vapour pressure in millibars at T deg.A.

It is found that on a strong monsoon day in July, with deep moist westerlies of 40 mph, the orographic lifting over the Western Ghats at Khandala can give rise to a maximum rainfall of only about 4 inches per day. This value is about half of what is actually recorded. The theoretical and the observed values have the same order of magnitude. The greater amount of the observed rain is probably due to the existence of penetrative convection over the Ghats even on strong monsoon days, whereby, the air flow does not conform to the ideal hydrodynamic stream lines.

42. Single-station forecasting by Radio-sonde Analysis.

D. VENKATESWARA RAO.

Precipitation indices based on evening Radio-Sonde ascents have been computed for Madras for the rainy period of August to December, 1946, in the manner suggested by Schell (Bull. Amer. Met. Soc., 1946, 27, 164). It is found that a high chance for precipitation within 12 hours of the radio-sonde ascent exists only if the index has a value of not less than 3, as compared with a value of 1 in the U.S.A. Further, when the

index lies between 3 and 5, the rain is mostly of the type of light showers, while when the index is more than 5, equal chances exist for light showers and moderate to heavy rain.

43. "Variation in the Normal Pressure Profile in the neighbourhood of South America, its influence on the S. W. Monsoon in India, and the effect of the sunspot on the variation of the Normal Pressure Profile."

K. S. RAMAMURTI, Poona.

In this paper the normal latitudinal distribution of pressure, P, in South America is assumed to be of the form,

$$P = \bar{P} + R \{ \sin 6 (\phi - E) - \bar{S} \}$$

and the effect on the June to September rainfall in the Peninsula and N.W. India of the variation in the parameters P, R, and E as the set of P's defining the equation varies from year to year is studied.

It is demonstrated that the more the transport of air to the South Atlantic the farther will the axis of the high pressure belt there be shifted from the equator. *That is, the equatorial cell of meridional circulation expands longitudinally with a strengthening of the circulation.*

The C. C. between mean annual sunspot numbers and R, the amplitude of the pressure profile has been found to be negative and significant.

44. "A preliminary examination of pressure at Poona."

P. S. SREENIVASAN and S. S. VENKATESWARAN

The paper deals with the analysis of pressure at Poona from 1889 to 1942. The standard error and co-efficient of variability are very high for October and comparatively higher for June, September and November and these are the months in which the monsoon generally sets in or retreats. The mean pressure was found to be maximum in December and minimum in July. Of the twelve correlation coefficients between any two consecutive months of the year, only the correlation coefficient of the months May-June is highly significant.

45. Rainfall at Patiala.

L. D. MAHAJAN, Patiala.

In this paper the statistical analysis of rainfall at Patiala, and its variability have been attempted.

Major rainfall takes place in the monsoon months from July to September. The mean winter rainfall is one-fourth of the mean summer rainfall. The mean annual rainfall of the last about fifty years is 25.85 inches, standard deviation 8.84 inches, coefficient of variability 34.20% and mean deviation 6.97 inches.

The annual rainfall obeys no law relating to time. The winter rainfall does not depend on the next or past summer rainfall and vice-versa. Often, abnormal high rainfall is followed by an abnormal low rainfall. The annual rainfall mostly depends on its summer rainfall and not on its winter rainfall, which is very small. The mean annual rainfall is irregularly decreasing with the lapse of years.

The average number of days associated with rainfall in a year is 44 and they are irregularly decreasing with the lapse of years. When the number of days associated with rainfall in a year is high, the annual rainfall of that year is also very often high. But the relation is not very rigid.

There is no simple periodic variation of the annual rainfall and the total number of rainy days in a year.

46. The mobility of the small ions of the atmosphere at Poona.

K. S. AGARWALA, New Delhi.

The results of 151 determinations of the mobility of the natural small ion, as derived from the simultaneous observations of the conductivity and the ion-content

taken at Poona at 10 hrs. I. S. T. during the years 1935 to 1937, are given and briefly discussed. The mean values of mobility are found to be $1.06 \text{ cm}^2. \text{ volt}^{-1} \text{ sec.}^{-1}$ for the positive ion and $1.09 \text{ cm}^2. \text{ volt}^{-1} \text{ Sec.}^{-1}$ for the negative ion. Frequency curves are also given; these indicate different mobility groups. The occurrence of higher mobilities during rain and of lower mobilities during haze has also been pointed out.

(d) Oceanography

47. Tropical Oceanography.

S. L. MALURKAR, Poona, 5

It is well-known that the equations of winds in meteorology and of currents in the oceans are almost similar. The equator is a barrier *ordinarily* for transport of air across it. But under certain circumstances, as in monsoon 'pulses' the air can cut across. The areas of high salinity and of density of sea water are very approximately in the same positions as where the atmospheric high pressure areas exist. The modification due to land masses is greater in the case of sea currents. The data available for working a detailed picture of ocean currents near the equator are few. But the climatic or mean picture given in most books resemble very much what one would have written about wind currents if only some mean values were known. It appears that 'pulses' of ocean currents cross the equator to the other side only at intervals when an accidental barrier is placed across the path of the west-ward moving current and the deflection towards the pole is made impossible by a suitable pressure gradient. The exact conditions when these favourable circumstances occur can not be determined unless one has detailed observations of salinity and temperature over a wide area on either side of the equator. The only general conclusion that one has is that the gradient of salinity and temperature is much smaller near the equator than near the temperate latitudes. This exactly corresponds to the smallness of the pressure gradient near the equator in the atmosphere.

General Physics, Properties of Matter, Acoustics, etc.

48. Further Studies on Thermal Repulsion

M. K. PARANJAPÉ, Poona.

In previous papers on the subject (Ramdas, Paranjape, Joglekar) observations had been made on the deflections of a light mica vane suspended in a thin vertical air cell whose faces are maintained at a small difference of temperature and it had been shown that the seat of thermal repulsion force is in the temperature gradient in air and that the phenomenon can be studied in its true simplicity when the convection is eliminated by taking a sufficiently thin air cell. The present writer resumed this investigation and studied the phenomenon at various pressures and in various gases. The results obtained are summarised below:-

1. As the air pressure was reduced from the atmospheric pressure to about 10^{-4} cm. of mercury, the thermal force increases at first, reaches a maximum and then decreases again.
2. As the initial position of the vane was varied from the hot to the cold surface it was seen that both the maximum thermal force and the optimum air pressure increase as either surface is approached.
3. Working with air cells of different thicknesses it was found that the product of thickness and the optimum air pressure was approximately constant.
4. A number of experiments were made with mica vanes of different perimeters and areas. There was found to exist a linear relationship between the area of the vane and the thermal force on it, while no regular relation whatever was seen between the thermal force and the perimeter. The possibility of the phenomenon being an edge effect was thus eliminated.
5. The effect of the thermal conductivity of the material of the vane was studied by replacing the mica vane with an aluminium vane. The difference in the behaviour was only a slight one in comparison with the large ratio of the thermal conductivities of aluminium and mica.

6. Experiments made with the mica vane parallel to the temperature gradient showed, contrary to expectation, quite a large deflection, small though in comparison with the deflection in the case when the vane is perpendicular to the temperature gradient.
7. The investigation was carried out using He, H₂, air, CH₄, A, CO₂, C₂H₄, SO₂, CS₂, CCl₄. As one moves down the series it is found that the maximum thermal force F_m and the optimum gas pressure P_m go on decreasing. Linear relation was found between F_m and the mean free path at N.T.P. The plot of $\log F_m$ and $\log P_m$ is a straight line.
8. It has also been shown that from the deflections of the vane in the 'parallel' and 'perpendicular' position respectively the 'accomodation coefficient' can be estimated.

49. Raw materials for glass industry in the Andhra

VAVILALA KRISHNAMOORTHY, Waltair.

The available raw materials for glass industry in the Andhra area have been studied; a case has been made out for four glass factories in the Andhra area at Vizagapatam, at Guntur, at Nellore and at Kurnool.

50. A new type of Hygrometer using cellophane.

B. SWAMINATHAN, Udaipur.

Cellophane undergoes very considerable expansion and contraction on damping and drying. This property was investigated, to find out to what extent it could be used for the construction of a hygrometer. The result of these investigations established (1) that a linear relation exists between the length of a cellophane strip and the vapour pressure of water vapour, (2) that the temperature effect on the length was negligible (3) that the values of α and β the ratio of the maximum weight of water vapour absorbed to the weight of dry cellophane and the coefficient of hygrometric expansion respectively are 0.5 and 0.073. These are high when compared to other hygrometric substances. It is therefore concluded that the substance is eminently suitable for use in the construction of hygrometers.

51. On the derivation of adiabatic relations for a real gas.

V. N. KELKAR, Poona.

In the present paper it is pointed out that in deriving the adiabatic relations for a real gas both the laws of thermodynamics (first & second) are not necessary as has been stated in standard text books of heat! and a simple and straight forward derivation is given on the assumption of the first law only. Taking Van der Waals's equation, a typical equation of state for a real gas, the relation obtained between pressure and volume is :-

$$p(v-b)^{\gamma} + \frac{\gamma}{(2-\gamma)} \cdot \frac{a}{v^{2-\gamma}} - \frac{\gamma+2}{(3-\gamma)} \cdot \frac{ab}{v^{3-\gamma}} + \dots = \text{Constant}$$

and that between volume and temperature is :-

$$T(v-b)^{\gamma-1} - \frac{a(v-b)^{\gamma}}{Rv^2} + \frac{\gamma}{2-\gamma} \cdot \frac{a}{v^{2-\gamma}} - \frac{\gamma(\gamma+2)}{(3-\gamma)} \cdot \frac{ab}{v^{3-\gamma}} + \dots = \text{Constant}.$$

The relation between pressure and temperature being complicated is obtained as an approximation :-

$$\frac{T^{\gamma}}{p^{\gamma-1}} + \frac{\gamma(\gamma-1)}{(2-\gamma)} \cdot \frac{ap^{2-\gamma}}{R^2T^{2-\gamma}} + \frac{a^2\gamma p^{3-\gamma}}{R^2T^{3-\gamma}} - \frac{\gamma(\gamma+2)}{(3-\gamma)} \cdot \frac{abp^{3-\gamma}}{R^2T^{3-\gamma}} + \dots = \text{Constant}.$$

52. Elastic Impact of Pianoforte Hammer.

R. N. GHOSH.

This paper summarises the dynamical theory of Impact of felt hammer upon a distance α from one fixed end such that reflected wave from the other distant fixed end does not reach the striking point during the time the hammer is in contact with

the string. Heaviside operational method leads to a solution in the form of a series consisting of *incommensurable terms with damping coefficients increasing with the order of the term* and tending to a limiting value. In the case of hard hammer the damping coefficients decrease and the terms are very much less incommensurable. These are the *essential differences* between the two cases that lead to smoothening down of the pressure and time curve between the hammer and the string.

53. Air Flow near Reed Vibrator

R. CHATTERJEE.

The paper gives an account of the experimental work determining air flow and pressure as air flows out through 1) chinks in a steady reed and 2) a vibrating reed. The velocity of flow is determined by hot wire anemometer and the pressure by a sensitive inclined manometer in the case of non-vibrating reed. The isobars indicate a region of low pressure near the reed and also a depression at a height of 1.5 cm. above the reed. In the case of the vibrating reed the pressure is detected by a pressure probe fitted to a microphone and a rectifier. The maximum value of pressure and velocity fall at the same regions indicating that the pressure is negative. Experiments are in progress and it is expected fuller details will be available in a short time.

54. On an analysis of Newton's second law of Motion

NARAYAN MISRA, Cuttack.

The second law states that the rate of change of momentum is *proportional* to the impressed force and takes place in the direction in which the force acts. The amendment suggested is that the word 'proportional' should be substituted by the word 'equal'. The second law is represented by the equation $P = K \, m \, f$. The various methods employed to determine the value of K have been shown to be wrong. The cause of the failure of all attempts to determine the value of K has been shown to be the fact that it is impossible to find K so long as P is found in terms of $m \, f$, i.e. in terms of rate of change of momentum it develops. From the equation $K = P/mf$ it may be seen that K cannot be found unless P and mf are measured independently. Force has been shown to be nothing but a rate of change of momentum. This conception of force provides a new method of finding the value of P . A comparison of this independent value of P and the rate of change of momentum developed by P shows that K is unity. The equation $P = K \, m \, f$ then becomes $P = mf$. So it is necessary to amend the law as suggested.

Spectroscopy

55. Hutchisson's Band Intensity Theory and C_2 (Swan) Bands in Flame Sources : Part I, Oxy-coalgas flames.

N. R. TAWDE and J. M. PATEL, Bombay.

Theoretical values of intensities in Swan bands have been calculated for C_2 (Swan) system by using Hutchisson's intensity integral in the manner done previously by Tawde and Patankar in the case of N_2 second positive bands. (Proc. Phys. Soc. 55, 396, 1943). These have been compared with those determined experimentally by photographic photometry for several oxy-coalgas flames (having coalgas and oxygen mixed in the ratios 1.2, 2.0, 3.0, 4.0, and 5.0). It has been noted that experimental results tend to show better agreement with theoretical values (a) for bands with lower vibrational quantum numbers, (b) when quantum numbers are interchanged and (c) for flame having fuel and oxygen in the ratio 4:1.

56. Hutchisson's Band Intensity Theory and C_2 (Swan) Bands in Flame Sources : Part II, Air-coalgas Flames.

N. R. TAWDE and J. M. PATEL, Bombay.

As a continuation of the Part I of the investigation, flames produced under uniform conditions of coalgas mixed with oxygen in one case and coalgas mixed with air in the other have been investigated. The fuel-oxygen or fuel-air mixtures are taken in the ratios 1.2 and 2.0. The theoretically predicted intensities when examined in relation

to experimental results reveal increasing departure between the two as air replaces oxygen in the fuel mixture. Attempts have been made to explain this and other relevant phenomenon.

57. Hutchisson's Band Intensity Theory and C_2 (Swan) Bands in Flame Sources : Part III, Meker Burner and other Common Flames.

N. R. TAWDE and J. M. PATEL, Bombay.

Further theoretical aspects of intensities of Swan bands in Meker burner, Bunsen burner and primus stove have been examined. The Meker burner flame has been investigated under two conditions i.e. (1) burner fully open to air and (2) burner practically open to air. Besides the experimental study of the intensity theory, many other points about the flames, viz. energy equilibrium, chemiluminescence, etc. have been examined and discussed in the light of the results.

58. Behavior of mercury line spectrum in presence of foreign gases.

N. R. TAWDE and K. S. KORGAOKAR, Bombay

While studying the effect of oxygen on nitrogen band spectra, our attention was drawn to the weakening or strengthening of certain emission lines of mercury (present as impurity) as a result of the presence or absence of these gases in the discharge tube. It was noticed that while nitrogen is practically neutral towards the mercury spectrum, oxygen or air quench the spectrum to a marked degree. The intensity of mercury lines undergoes quick reduction and goes below about half the original intensity when the pressure of oxygen is about 1 mm. The fall in intensity is confined to almost all the lines and not merely to the resonance line 2537 Å. This problem has been pursued quantitatively by taking the photographs recording the mercury lines at various known pressures of these foreign gases.

59. Study of Swan Bands in Under-glycerine Spark.

N. R. TAWDE and K. GOPALKRISHNAN, Bombay.

It is well-known that a condensed spark between carbon electrodes under glycerine gives Swan bands. When producing these bands by this method, it was noticed that they undergo relative intensity changes as a result of change in the conditions of electrical circuit causing the spark. In order to study this aspect in terms of energy reactions going on in the spark in presence of glycerine, quantitative study of the enhancement of C_2 and CH bands among themselves or with respect to each other has been undertaken by change of electrical conditions. Control and knowledge of precise electrical conditions offered some difficulties. Attempts have been made to solve them. Preliminary qualitative observations have shown some interesting results.

60. Production of Swan Bands in Discharge through Co.

N. R. TAWDE and M. G. K. MENON, Bombay.

In view of the fact that Pretty obtained Swan bands by passing condensed discharge through CO, we tried to produce these bands from CO, using undamped electrical oscillations from a valve oscillatory circuit to excite the discharge. The spectrum in this case, was, however, found to consist of only CO (Angstrom system). It is known that Swan system is favoured generally at higher pressures and h.f. discharge is not usually possible at relatively high pressures of the order of 2 to 3 mm. of mercury. Consequently, the discharge was excited by damped electrical oscillations using high current density. As a result Swan bands appeared along with some Angstrom bands. To see if Swan bands could be suppressed, pressure was varied and it was found that with pressure reduction, Swan system became weaker and weaker and Angstrom bands of CO became very prominent. Attempts are being made to observe the critical pressures at which one system or the other could disappear.

61. Distribution of Field in H. F. Discharges.

N. R. TAWDE and G. K. MEHTA, Bombay.

The distribution of potential between the electrodes of h.f. discharge undergoes considerable change as the pressure of the gas is reduced. At higher pressures, there is an accumulation of positive space charge near the electrodes where the major fall

of potential occurs. At lower pressures the distribution of potential is entirely different. Theoretical considerations regarding the possible distribution of potential before and after the striking of the discharge agrees well with our observations on h.f. discharges. The fact that it is unnecessary to postulate any other ionisation mechanism than that due to electronic collision and that there is small loss of carriers due to the oscillating field, make the study somewhat simpler but interesting. Our experiments in this direction throw much light on the mechanism of the discharge.

62. Study of Polarisation of Fluorescence in Dye-stuffs.

N. R. TAWDE and N. RAMANATHAN, Bombay.

The polarisation of fluorescence of dye-stuffs in solution has been investigated in terms of the viscosity, concentration and temperature effects. The dyestuffs for which so far no observations are available, have been chosen for the study. Large number of cases of variations in polarisation are generally in accordance with results of previous workers. But some cases of divergence have also been noted. These cases of divergence are being more thoroughly investigated and examined in the light of the recent theory of Vavilov.

63. Note on the limiting mass of a rotating white dwarf.

G. BANDYOPADHYAY.

Chandrashekhar has proved that the mass of a white dwarf star cannot exceed a certain limit. The present note examines if this condition is changed when the white dwarf has a rotation. Investigation of cases where the rotation is not very large (which would imply rotations slower than thousand times the rotation of earth) it is proved that there exists an upper limit to the mass of the rotating white dwarf which is exactly identical with Chandrashekhar's limiting mass. It is further shown that the masses of the rotating white dwarfs approach this limit from below.

SECTION OF STATISTICS

PRESIDENT : S. N. ROY, M.Sc., F.N.I.

Theoretical Statistics

1. On the Moments of the Mean Deviation in samples from a Normal population.

S. JANARDANA AIYER, Trivandrum.

The Standard error of the Mean-Deviation η defined by

$$\eta = \frac{1}{n} \sum_{i=1}^n \left| x_i - \bar{x} \right|$$

in samples from a normal population has been derived by R. A. Fisher. In this paper, by the application of Characteristic Functions the first four moments of η have been obtained.

2. On a class of Integrals occurring in Statistical Problems.

S. JANARDANA AIYER, TRIVANDRUM.

In many statistical problems integrals of the type

$$I(k; n) = \int_0^{\infty} e^{-\frac{kx^2}{2}} \left[\int_x^{\infty} e^{-\frac{v^2}{2}} dv \right]^n dx$$

where k and n are positive integers occur. It is extremely difficult to obtain the exact value of this integral and the evaluation of such integrals is usually by means of quadrature. Pearson and Hojo have obtained by quadrature the values of this integral for particular values of k and n . In this paper, a differential difference equation satisfied by $I(k; n)$ has been derived, which may be used for its evaluation.

$I(k; n)$ satisfies the relation

$$\frac{\delta I(k; n)}{\delta k} = -\frac{1}{2k} I(k; n) + \frac{n}{2k(k+1)} \left(\frac{\pi}{2} \right)^{\frac{n-1}{2}} - \frac{n(n-1)}{2k(k+1)} I(k+2; n-2)$$

In particular

$$I(k; 0) = \left(\frac{\pi}{2k} \right)^{\frac{1}{2}} \quad \text{and} \quad I(k; 1) = \frac{\frac{\pi}{2} - \sin^{-1} \left(\sqrt{\frac{1}{1+k}} \right)}{k^{\frac{1}{2}}}$$

$$I(k; 2) = \left(\frac{\pi}{2k} \right)^{\frac{1}{2}} \left[\frac{\pi}{2} - 2 \sin^{-1} \left(\sqrt{\frac{1}{1+k}} \right) + \sin^{-1} \left(\frac{1}{1+k} \right) \right]$$

3. On the Moments of Mahalanobis' D_1^2 statistic.

D. P. BANERJI, Mymensingh.

Mahalanobis' D_1^2 statistic is the square of the generalised distance. Here the moments and generating function of the moments have been found with respect to D_1 .

4. Bias in Double Sampling Technique.

(Mrs.) CHAMELI BOSE, Calcutta.

The different aspects of double sampling technique have been discussed by the author in *Sankhya*, June, 1943 and in the thirty third session of Indian Science Congress 1946.

The present paper works out the bias in some of the different sampling procedures involved in double sampling technique. This bias, found to exist for some types and sub-types of double sampling technique, is due to certain constraints implicit in those types and sub-types.

5. An Application in the Multiple Factor Analysis.

P. K. BOSE, Calcutta.

In "Studies in Educational Tests No. 3" published in *Sankhya*, Vol. 1, the authors tried Spearman's "Two Factor Theory" for the analysis of marks in different subjects in the School Leaving Certificate Examination of the United Provinces for 1919. But as the various tetrads combinations $\alpha\beta\gamma\delta$ differed significantly from zeroes, the method failed.

In this paper an attempt has been made to use Thurstone's method of "multiple factor" for the analysis of the above data. It may be mentioned that the tests are not properly standardised mental tests, so the interpretation of all the factors is not possible.

6. An Approximate Method for Grouping the Characters in Anthropometric Measurements.

P. K. BOSE, Calcutta.

The B-coefficient defined by Holzinger may be written as

$$B(u) = 200(n-p)S/(p-1)T$$

where the symbols on the righthand side have their usual significance. This coefficient has been used to group the characters on the basis of their inter-correlations. The grouping begins by selecting two characters which have the highest correlation, to this is added the variable for which the sum of the correlations with the preceding is highest. Continuing the above process we can finally fix up the groupings.

In anthropometric measurements we measure various characters. If we can make suitable groupings of these characters by a study of their inter-correlations then for the final statistical analysis we can considerably diminish the number of characters by taking one or two characters from each group.

The sampling distribution of $B(u)$ is not yet known but still using the B-coefficient we can approximately group the characters.

7. On the Inadequacy of Measuring the Peakedness of a Distribution curve by the Standardised Fourth Moment.

M. C. CHAKRABARTY, Dacca.

The common practice of determining the peakedness of a distribution curve in relation to the corresponding normal curve by the standardised fourth moment β_2 is known to be defective but the *gegenbeispiele* cited are rather pathological in character and may seem to be feats of mathematical gymnastics. The paper demonstrates by the distribution curves of simple statistics derived from well-known population that the peakedness of the distribution curve in relation to the corresponding normal curve cannot be determined by the sign of $\beta_2 - 3$.

8. On the Missing Plot Technique.

ANUKUL CHANDRA DAS, Calcutta.

By Fisherian technique we are to find out the sum of squares due to error and that due to treatment plus error by putting some unknown algebraic quantity (Y) for the missing values; taking their minimised values with respect to Y 's their estimates are obtained. Here it is shown that the Fisherian technique will ultimately lead to the same result as would have been obtained by the general theory of the analysis of variance without taking the missing plots into account at all.

9. The Analysis of Variance in a Multivariate case.

ANUKUL CHANDRA DAS, Calcutta.

For a p -variate case the sum of p variates with certain weights are taken to represent a resultant univariate. The F or t^2 is calculated and maximised with respect to the combining weights to give the multivariate generalisation. Hence follows:

Theo. 1. The multivariate generalisation of F for two spaces of rank n_1 and n_2 is given by the p roots of the determinantal equation same as in the case of the p statistics when the sample co-variances between any two variates are given by their sum of product per d. f. along those two spaces. For $n_1=1$ F/P is the same as the D_1^2 statistic.

Theo. 2. In the normal case the p roots F of *Theo. 1.* follows the distribution of p statistics with degrees of freedom equal to the rank of the two spaces and for $n_1=1$ F/P follows the D_1^2 distribution with n_1 d. f.

The more general case than the double classification can be arrived at as a corollary.

10. On the Canonical Multiple and Partial Correlations.

ANUKUL CHANDRA DAS, Calcutta.

Starting from the concept of multiple and partial correlations, certain generalisations have been made.

Applications of these generalised co-efficients have been discussed in various problems in statistics.

11. Double Sampling with Many Auxiliary Variates.

BIRENDRANATH GHOSH, Calcutta.

The various applications of the technique of "double sampling" with one auxiliary variate have been discussed by Cochran (1939). The most usual method is to take a small sample of size n in which the variate to be estimated y , and auxiliary variate x , (linearly correlated with y) are recorded. In a second sample of larger size N only x is recorded, which is easier to enumerate than y . The estimate for the mean value of y in the population is given by $y = a_n + b_n (\bar{x}_N - \bar{x}_n)$, where a_n , b_n and \bar{x}_n are estimates from smaller sample and \bar{x}_N is from the larger sample.

If instead of a single auxiliary variate x , we take k variates of the same type x_1, x_2, \dots, x_k , the estimate will be given by

$$y = a_n + \sum_{i=1}^k b_i (\bar{x}_{iN} - \bar{x}_{in})$$

It can be easily shown that this will be an unbiased estimate and its variance, will be given by (with large sample approximations)

$$\frac{\sigma_y^2(1-R^2)}{n} \left\{ 1 + k \left(\frac{1}{N} + \frac{1}{n} \right) \right\} + \frac{1}{N} \left(\sum_{i=1}^k \beta_i^2 \sigma_i^2 + 2 \sum_{i=1}^{k-1} \sum_{j=i+1}^k \beta_i \beta_j \sigma_i \sigma_j \rho_{ij} \right)$$

where σ_i^2 is the variance of x_i , ρ_{ij} is the total correlation coefficient between x_i and x_j , β_i is the population value of b_i , R is the multiple correlation between y and x_1, x_2, \dots, x_k .

12. Tests of Significance based on Conditional Probability.

H. K. NANDI, Calcutta.

In regression and other problems it is assumed for applying a test of significance that some of the random variables are constant. In fact, this assumption is not necessary when the distribution of the statistic which supplies the test of significance, is independent, on the null hypothesis, of the distribution of the random variables which are held constant—as is the case with the simple and multiple regression and correlation coefficients. The power of these tests, however, will be affected by the distribution of these variables and it has been found in this paper that the t and F tests for simple and multiple regression and correlation coefficients retain their optimum properties in a wide class of distributions of the random variables held constant.

13. Sequential Tests of Composite Hypotheses.

H. K. NANDI, Calcutta.

The chief importance of a sequential test lies in the reduction of the average amount of sampling necessary for coming to a decision at a certain level of risks. Such a test is available in testing a simple hypothesis against a simple alternative. In case of composite hypotheses, however, the formulation of a test procedure has been made to depend upon a risk function which does not, in most cases, lead to a solution. In these situations, it is shown in the paper how Neyman-Pearson's optimum critical regions can be utilised in evolving sequential test procedures and what peculiarities do they impress on the Operating Characteristic and Average Sample Number curves. It is found that (i) the ratio of the probability distributions of a statistic can be availed of when the statistic is distributed normally with a variance $O(1/n)$ and (ii) the unbiased critical regions play an important part in controlling the Operating Characteristic and Average Sample Number curves.

14. On the Mean and Mean Difference of symmetrical observations in a sample from a Normal Population.

K. C. S. PILLAI, Trivandrum.

In this paper the distributions of $(x_{n-1+i} + x_i)/2$ and $(x_{n-1+i} - x_i)/2$ are obtained as series, x_i being the i -th observation in an ordered sample of size n taken from a normal population. The rapidity of convergence of the series has been observed by considering the first few terms of the series for different values of n and i .

15. On T-test in ordered samples from a Normal population.

K. C. S. PILLAI, Trivandrum.

In this paper the simultaneous distribution of the centre $M = (x_n + x_1)/2$ and the mean range $W = (x_n - x_1)/2$ is obtained in the form :

$$P(M, W) = \frac{n(n-1)}{\pi} (2/\pi)^{(n-2)/2} e^{-n(W^2 + M^2)/2} W^{n-2} [F_0(n, w) + F_1(n, w)M^2 + F_2(n, w)M^4 + \dots]$$

where $F_i(n, w)$ are functions involving n and even powers of w and x_1 and x_n are the first and last observations in an ordered sample of size n taken from a normal population. The correlation coefficient between M and W is observed to be zero. From $P(M, W)$ the distribution of $T = M/W$ has been worked out. The five per cent levels of significance of T have been calculated for small values of n .

16. Sufficiency and Testing of Composite Hypothesis.

S. N. ROY, Calcutta.

It is well known that a shared sufficient set of statistics for all the parameters of the problem ensures under certain mild restrictions the existence of uniformly most powerful test of a simple hypothesis and vice-versa. The present paper shows that

in the case of composite hypothesis (i) a shared sufficient set of statistics for the free parameters ensures the availability of valid tests for the fixed parameters of the composite hypothesis, (ii) some further restrictions (discussed in the paper) on the form of the probability density function in the sample space ensure the existence of the most powerful test with regard to any given alternative, while (iii) yet further restrictions in terms of sufficiency (explained in the paper) ensure that this most powerful test with regard to a particular alternative should also be uniformly most powerful at any rate in a slightly extended sense suggested in the paper.

17. On an Optimum Property of Multivariate Tests obtained from Linear compounds.

S. N. ROY, Calcutta.

In papers offered to earlier sessions of the Indian Science Congress the author discussed the optimum property of the multivariate tests developed earlier by him and others, in terms of average power, the weightage for averaging over parametric space being often related to Bhattacharya's 'distance function'. The tests themselves, as is well-known, were obtained by a process which consisted in taking a linear compound of the variates, treating that compound as one variate, setting up the corresponding well-known optimum univariate statistics for the different hypotheses, and maximising with regard to the compounding co-efficients thus ultimately leading to quantities defined in terms of the observations (and sometimes also of the hypothesis). The present paper (i) shows that in a certain sense and under certain limitations (explained in the paper) these tests are also locally most powerful and locally unbiased, and (ii) also discusses the mathematical mechanism by which the 'maximisation process' leads to the optimum property in question.

18. On the exact Distributions of S. S. Wilks' L_{mvc} and L_{vc} criteria for testing hypotheses.

K. BHASKARA VARMA, Trivandrum.

The paper deals with a method of deriving the exact distributions of certain sample criteria for testing equality of means, equality of variances and equality of covariances in a normal multivariate population of k variables, on the basis of a sample of size n .

The sample criteria have been developed by S. S. Wilks—by the Neyman-Pearson Method of Maximum Likelihood Ratios and the exact moments of these test criteria, when the hypotheses are true, have also been worked out by him. These moment functions involve Gamma functions; and the exact probability distribution functions are too complicated, except in the cases where $k=2$ or 3 . For such complicated cases, approximate distributions have been derived; but there is wide disparity between the approximate and exact distributions.

In this paper, the exact distributions of L_{mvc} and L_{vc} have been obtained from which the values of L_{mvc} and L_{vc} corresponding to any given level of significance may be found out with any desired degree of accuracy. The values of L_{mvc} and L_{vc} at the 1% and 5% levels for different values of k and n have also been tabled.

Vital Statistics

19. Studies on the Sampling Procedure for a General Health Survey.

K. K. MATHEN, Calcutta.

The application of the standard methods of sampling to a general health survey is discussed on the basis of experience gained in the course of the health survey carried out at Singur Health Centre Area under Dr. R. B. Lal. The claim of family as the unit of sampling is examined. Circumstances which disturb the randomness of a sample are given. Chief among these are the biases introduced by the absence of people at the time of survey and refusal of certain sections of the population to submit to certain clinical examinations. The inaccuracy introduced by the forgetfulness of the subjects with regard to history of sickness during the previous year, is also studied. Certain corrections for these inaccuracies are suggested.

20. Decrease of Sex-ratio in order of Birth.

N. T. MATHEW, Calcutta.

A study of the records of the age composition of about 500 working class families from Bengal reveals that there is a steady decrease in the proportion of male children when the order of birth increases; the sex-ratio among first born being 57.4 and the ratio among children of birth-order nine and above being 45.5. It has been shown that the downward trend is statistically significant. The result has been confirmed using published pedigrees from other countries.

21. Statistical study of the influence of age, height, weight, diet, marital status, and religious community of persons on their blood pressure.

N. T. MATHEW, Calcutta.

In this paper which is based on detailed measurements of 2,800 persons from Bengal, the relation between blood pressure and the above-mentioned factors have been analysed. It is shown that systolic pressure increases steadily from age 8 reaching a maximum at about age 19. Thereafter there occurs a slight fall and from age 25 onwards there is probably a very slow increase. It is doubtful whether diastolic pressure has any progressive trend with age. There is fairly high correlation between blood pressure and weight, the co-efficient being 0.19. The correlation between blood pressure and height is small but positive. There is an apparent difference between the average blood pressure of Hindus and Muslims, Hindus having higher blood pressure but on closer examination this difference is seen to be due to factors other than community. Contrary to previously reported results, vegetarians show higher blood pressure than non-vegetarians. Among Hindus married persons appear to have higher blood pressure than un-married persons before the age 28 and lower blood pressure after that age. Among Muslims married persons appear to have higher blood pressure than un-married persons at all ages.

22. The Problem of Statified Sampling in Human Population.

S. JANARDAN POTI, Calcutta.

In economic enquiries as well as in vital statistics problem, the problem of estimation of the number of individuals possessing a certain specified character in a given population often becomes necessary. If the total population is scattered in the form of units or groups of varying sizes over the area which the population inhabits and the number of individuals inhabiting each of these is known apriori, as is the case of village population, the method indicated in this paper can be very fruitfully employed in the designing of sample surveys.

Economic Statistics

23. Improvement in the economic condition of the Bengal cultivators as a result of Debt Conciliation Act.

D. M. GANGULI, Calcutta.

The Debt Conciliation Act was passed by the Govt. of Bengal in 1935-36 to give relief to the agriculturist and it is believed that their economic condition improved as a result of this. To examine this point figures for the arrivals of jute into Calcutta were examined. It is presumed that if the economic condition of cultivators had actually improved, their holding power also must have increased and comparatively less jute, the most important cash crop of Bengal, would be sold during the first part of the year. Such decrease in sale may also be due to fall in prices. As figures for actual sale are not available arrival figures for periods 1922-23 to 1928-29, 1929-30 to 1935-36 and 1936-37 to 1942-43 and prices of raw jute for the same period were examined for the purpose.

It was found that there was a heavy fall in prices during the second period as compared to the first and the seasonal for the arrival figures for the second period had a significant shift towards the right as compared to the first. This is as we expected. Prices again rose during the third period as compared to the second but there was no

shift between the seasonals of jute arrivals for these two periods showing that the holding power of the cultivators have actually increased and the two opposing forces—high prices and improved economic conditions—counterbalanced each other.

24. Trend of bullion prices in India and abroad.

T. GHOSE, Calcutta.

During the past few years the increase in bullion prices in India has surpassed all previous records with the result that Indian prices stand at a very high level in relation to prices ruling at important bullion centres of the world. The reason for this have been fully discussed. Production, stock and prices of bullion, especially of silver, have been analysed. Attempts have also been made to estimate the future price structure of silver but it should always be remembered that such an estimate is never complete due to the presence of the three unknowns in the demand curve for silver viz., (1) future hoarding of silver in India, China and other Asiatic countries, (2) U.S.A. 'silver bloc' future position and (3) future industrial use of silver with the advent of the atomic age.

Correlation between total production of gold and world economic activity demonstrates that the total activity is expanded at the rate of 4% per annum while the rate of gold output has varied between 2 to 3%. The tentative conclusion is that unless gold production is brought in alien with economic activity there is little likelihood of a fall in gold prices from its present height; or unless gold is completely thrown out of influence from the field of monetary mechanism of the world.

The discussion has been pushed a little further to ascertain whether International Monetary Fund should stabilise world silver prices by buying and selling silver at fixed price in terms of dollar or of gold to bring about monetary and exchange stability of the member nations.

25. A statistical analysis of Family Budgets relating to subordinate Government servants in Trivandrum.

N. GOPALAKRISHNAN NAIR and R. NELAYUDHAN NAIR, Trivandrum.

A representative sample of the family budgets of sub-ordinate Government servants in Trivandrum has been analysed with a view to ascertaining how the total expenditure of a typical family is distributed under various heads. The total expenditure under different heads per equivalent adult have been calculated for each family and the budgets are classified into four expenditure groups based on the total expenditure per adult. The regression of each item on the total expenditure has been measured for all the groups separately to verify Engel's Law of Expenditure. The relative urgency of each item of expenditure in a family has been determined for the different expenditure groups separately.

The coefficients of variation in expenditure on different items, the income elasticity of demand for the various items and the correlation between expenditures on different food groups have been calculated for all the expenditure groups and relevant inferences drawn.

26. A formula for the cost of living index of a class for a region.

A. R. SEN, Lucknow

This paper attempts to build up a formula for the cost of living index for a region based on the cost of living indices for the various homogeneous sub-regions.

A definition of homogeneity of the sub-regions have been given and the estimate and the error of the estimate have also been given. Even if the sub-regions are not homogeneous, the best estimate has been worked out.

Agricultural Statistics

27. Crop estimation in India.

D. M. GANGULY, Calcutta.

Acreage under a crop and its rate of yield are two factors which go to build up the total outturn of the crop. In temporarily settled areas of India, the acreage figure

is collected through the Patwaris, which is considered to be reliable and the higher values of the trade returns over the official estimates are attributed to errors in official estimates of yield rate, which are considered to be underestimates. But the work of Dr. Panse in C.P. and Berar during 1944-45 and 1945-46 show that the official yield rate estimates are almost always higher than the actuals. This definitely shows that acreage figures as collected by the Patwaris are gross under-estimations (which in certain cases may be even as wide as 38 p.c.). Among the permanently settled areas it is in Bengal only that the problem was successfully tackled by Prof. Mahalanobis by a random sample method. Figures for jute show that the estimates of Prof. Mahalanobis differed from the actual based on trade returns by 3.6% in 1944-45 and by 0.3% in 1945-46.

The technique of determining the yield rate by random sample method has been more or less successfully developed by different Institutions in India. A wider application of these methods is the only necessity in this direction. But in case of area estimation no improvement worth its name has been done except in Bengal and the facts already stated show that the figures collected by methods other than those based on random sampling are of extremely doubtful accuracy. Random Sample Method which has been successfully applied in Bengal may be tried in other tracts also, and in the temporarily settled areas the services of the Patwaris themselves may perhaps be utilised for this purpose.

28. Statistics relating to rotation of crops in Bengal obtained as a bye-product of sample survey of crop acreage.

N. T. MATHEW and AMALENDU GANGULY, Calcutta.

In the sample surveys conducted in Bengal by the Indian Statistical Institute during the years 1944 to 1947 for estimating the acreage under different crops, a certain proportion of grids have been kept unchanged from season to season. These grids have been used in the present paper to study the pattern of distribution of land under different crops, and also the changes in this pattern from season to season. Interesting results have been obtained for the two districts Noakhali and Rangpur.

29. Relation of 'border-bias' to size of cut in crop-cutting experiments.

N. T. MATHEW, Calcutta.

Among the many problems which arise in the development of a practical sampling technique for the estimation of yield-rates of crops, the problem of ascertaining the most suitable size of sample-cut is a very important one which has not yet been fully solved. Considerations of cost and convenience make it desirable to use a small-size cut, but the need of avoiding bias (which is found to be associated with very small sizes) makes it imperative to use a size large enough for the purpose. The experience of the Indian Statistical Institute has been that with sizes of about 100 sq. ft. and over border bias does not exist in the case of crops like jute, paddy, wheat, barley etc.

In the present paper the results of a series of crop-cutting experiments conducted on jute in Bengal in September and October 1947 with different sizes of cut are given. It is seen that for the jute-crops, bias vanished even with cuts smaller than 100 sq.ft. Some of the results of crop-cutting experiments in previous years are also given.

Educational Statistics.

30. A note on the Reliability of Tests.

P. D. SHUKLA, Simla.

The usual formulae for evaluating the reliability of psychological tests (Intelligence Tests, Aptitude Tests etc), are time taking. From practical point of view it is necessary to have a formula which gives the reliability quickly and approximately. One

such formula has been worked out in this note which gives the reliability $\rho = \frac{\sigma -}{\sigma}$

where σ is the standard deviation of the test.

It is also shown in the note that a fairly big test, whose reliability-coefficient is 0.5, is not good for use and must be rejected.

Industrial Statistics.

31. Statistical Control of Yarn Quality in Textile Industry.

G. D. MATHUR and B. SARKAR, Ahmedabad.

The paper shows the possibility of statistical control over yarn quality in textile manufacture.

In a ring spinning frame, it is not possible to get the desired count with one set of machine adjustments. Average count varies from time to time and constant adjustment is necessary to bring the average count very near to the desired value subject to the condition that the average count can be altered by a fixed amount by every turn of the machine wheel. The minimum size of the sample for the determination of the average, subject to different percentages of risk is considered. It is found that the size of the sample n should be given by

$$n = \frac{4\sigma^2}{u^2} \quad \text{subject to 5\% risk}$$

where σ = the population S. D. of count

u = the unit amount by which the machine count can be altered.

Control limits have been found on the basis of 5% risk for any group of machines spinning a particular count.

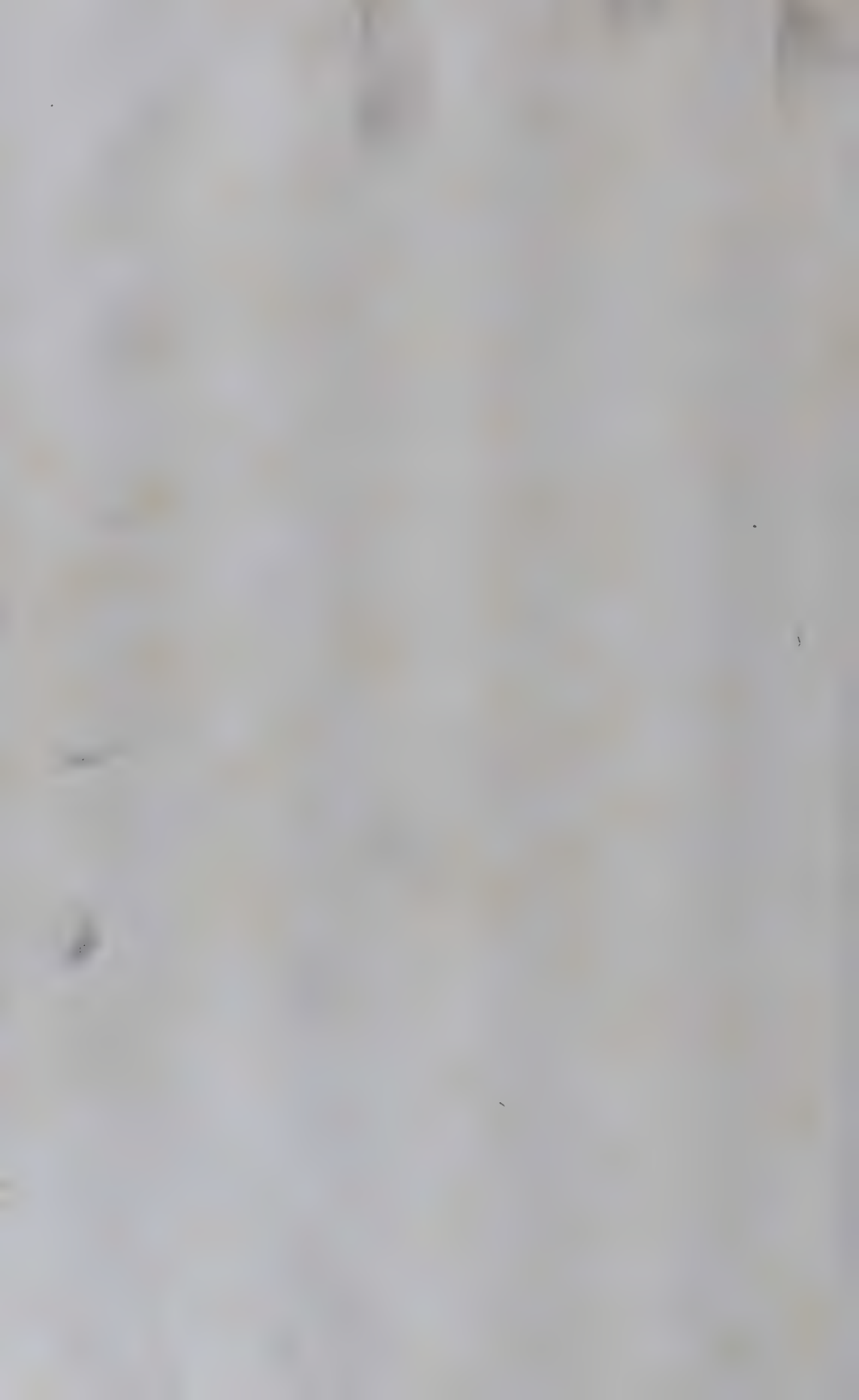
The paper also discusses control chart on variation in count, routine checking of "Between day" and "Within day" variations in count. This also shows a method of comparing as to how much variations are being added up in individual spinning processes so that any variation, significantly higher than normal, at any stage, can be removed. The same method is shown to be useful for the comparison of variations added up in different processes, in different mills or in different sections of the same mill.

32. A Note on the Location of Industries in India.

D. V. RAJALAKSHMAN, Madras.

Although various factors have to be considered in studying the regional distribution of industries, statistical measures adopted to estimate the degree of concentration are based only on the figure of industrial employment. Different ratios are evolved to measure the location of industries taking into consideration the industrial population of the country and workers employed in different industries. Since the war has influenced to some extent the employment position in different industries, an attempt is made in this paper to study the regional concentration of the important large scale industries in different provinces in India after the war by taking the employment figures for factories in 1945.

Defining the location factor for a given industry in a given region to be the ratio of the percentage of the national total of the given industry to be found in that region to the percentage of all industry in the region, these ratios and the coefficients of localisation are calculated for all provinces and for different industries. The effects of the changes in employment on location for some important industries are also studied in this paper by comparing with the situation before the war.



SECTION OF ZOOLOGY AND ENTOMOLOGY

PRESIDENT : PROF. A. B. MISRA, D.Sc., D.Phil. (Oxon.) F.Z.S., F.R.E.S.

1. Occurrence of *Isospora dirumpens* Hoare in the intestine of the grass snake, *Natrix piscator*, at Muteswar.

H. N. RAY and HARBANS SINGH, Mukteswar-Kumaun

The occurrence of *Isospora dirumpens* Hoare, has for the first time been reported from the grass snake, *Natrix piscator*, in India at a height of 7,500 ft. above the sea level. The type species was reported from the puff-adder, *Bitis arietans*, occurring in Entebbe, Uganda.

The site of infection and the structure of oocyst compared well in all respects with that of *I. dirumpens* except that in the majority of sporocysts the residual body presented a scattered appearance rather than a compact mass as described by Hoare in 1933.

2. On a collection of Cestodes from marine food fishes of Trivandrum coast.

P. RAMAVARMA RAJA, Trivandrum.

There are numerous species of Nematodes, Trematodes and Cestodes occurring as internal parasites in marine food fishes of the Travancore coast. Of these Trematodes and Nematodes are very prevalent, while Cestodes have, so far, been found to be represented only by three species and three larval forms. *Tetrarhynchus herdmani*, Shipley and Hornell 1906, is now recorded for the first time from the intestine of a shark (*Chiloscyllium*) the previous record having been only from *Rhynchobates djiddensis* and *Dasybates Walga*.

Cephalobothrium abruptum Southwell, 1911, was found in the spiral valve of *Pteroplatea micrura*. The host was heavily infected and contained one hundred and twelve specimens. *Gymnorhynchus malleus* (Linton 1924) is a parasite in the spiral valve of *Pteroplatea micrura*. Though the general characters of the specimen now collected, namely the arrangement of spines, muscle fibres, vitelline glands and eggs conform with the description of the type specimens, the head is much thinner and shorter.

The larval forms include a collection of Plerocercoid larvae, larvae of *Gymnorhynchus* and cysts of *Tetrarhynchus*. The Plerocercoid larvae were obtained from the mesentery of *Trichiurus savala*. Since the internal structure of this larva is indistinguishable, it has not been possible to determine the species to which it belongs. The *Gymnorhynchus* larva, also collected from the mesentery of *Trichiurus savala*, evidently belongs to the species *G. gigas*. Two cysts of *Tetrarhynchus* were obtained from the peritoneal cavity of *Lutjanus*. This evidently belongs to Vaullegeard's first division of *Tetrarhynchus*, namely *T. lingualis*. Similar cysts have been previously described by Shipley and Hornell from the peritoneal cavity of *Balistis mitis*.

3. Tube building organs of Polychaetes.

P. R. SADASIVAN TAMPI, Madras.

Dalyell's account (1853) of the tube building habits of polychaetes has been mainly responsible for the wide interest among naturalists on this subject. A few of the common tubicolous polychaetes like *Diopatra*, *Dasychone*, *Hydroides*, *Sabellaria*, *Chaetopterus*, *Phyllochaetopterus*, *Loimia*, and *Nicolea* have formed the subject for this study and observations have been made on the process of tube construction. The position and structure of the building organs and of the glands concerned in tube building have been determined. The structure of the tube building organs depends on the nature of the

materials with which the tubes are formed. Sabellids usually possess a complex building organ at the base of the branchial crown where fine mud particles are stored, mixed with mucus secretion and passed out in the form of strings between a pair of parallel folds. In the Sabellarids and Terebellids where the tubes are composed of sand grains, they possess accessory structures with great manipulative capacity. All the tubicolous polychaetes possess glands usually situated on the ventral side of the anterior part of the body which are capable of secreting large quantities of mucus, helping in the formation of the tube. These glands are usually groups of secretory cells which may be distinguished from the simple ectodermal gland cells. The various adaptation for tubicolous life also mentioned and discussed.

4. Genital papillae (suckers) and Sperm-sacs in the pisionid Polychaete, *Pisionidens indica* (Aiyar & Alikunhi).

K. H. ALIKUNHI, Madras.

A detailed account of the unique polychaete *Pisionidens indica* was given by Aiyar and Alikunhi (1940, 43). The present communication embodies the results of studies on the developmental history of such accessory structures in the male as the genital papillae (Suckers), the sperm-sacs and the copulatory organs.

The genital papillae (suckers) make their appearance only when the worm attains sexual maturity. Their resemblance to the ventral suckers of Blepharocericid larvae is striking. Full details of their structure and working are given.

With the formation of the rudimentary genital funnel in apposition with the nephridial swelling, the distal portion of the nephridial duct gets hypertrophied and surrounded by a thick muscular sheath. The cells of the nephridial duct in this region get loaded with numerous refractile granules. The copulatory organ is formed *de novo* as a prologation of the body-wall at the base of the ventral cirrus which gets flattened and foliaceous. The nephridial duct opens at the tip of the copulatory organ which is completely retractile.

The homology of the sperm-sacs and the copulatory organ is the same as in the allied genus *Pisione* (Alikunhi, 1941 & 1947)

5. On *Anophthalmus* (Fam : Hesionidae)—A new genus of Polychaetes with descriptions of four new species from the sandy beach of Madras.

K. H. ALIKUNHI, Madras.

In the course of an investigation of the fauna of the sandy beach, Madras, several minute, blind Hesioned polychaetes were found to be fairly common in the inter-tidal sand. The present communication embodies descriptive accounts of four new species, all belonging to the new genus *Anophthalmus*.

Anophthalmus gen nov. :

Minute blind worms, with 12 to 40 segments : head with three antennae, two palps and three pairs of tentacular cirri ; cirri without basal articles ; parapodia biramous ; dorsal bristles simple ; ventral setae compound ; anal plate either entire or bifid ; with two long anal cirri ; pharynx with a crown of papillae but without jaws ; and sexes separate.

Anophthalmus erythracus n.sp. and *A. splendens* n.sp. differ from each other in the relative size of the tentacular cirri, in colouration and in the structure of the anal plate. *A. longicirrus* n. sp. is closely related to *A. elegans* n. sp. from which it differs in colouration, relative size of tentacular cirri, nature of setae and the anal plate.

Full descriptions of the species are given together with a discussion on their relationships.

6. Osmoregulation in penaeid prawns.

N. KESAVA PANIKKAR, Madras.

In continuation of the studies on the osmoregulation of Palaemonid prawns. (Journ. Mar. Biol. Assoc. U. K. Vol. 25, 1941) investigations have been made on the adaptation and osmotic behaviour of three penaeid prawns of commercial importance on the Madras

Coast. viz. *Penaeus indicus*, Milne Edwards, *P. carinatus* Dana and *Metapenaeus monoceros* Fabricius. These species are well known for their tendency to migrate into estuaries and backwaters and their adaptational powers have been experimentally studied together with corresponding observations on the salinities of their natural habitats. Of the three species *Metapenaeus monoceros* is the one which can survive the highest salinity ranges both low as well as high i.e. from about 3 per mille. to 50 per mille. Less tolerant to low salinities is *P. carinatus* whereas *P. indicus* has a comparatively limited range as it does not survive in the low and high salinities tolerated by either of the above species. Preliminary studies based on cryoscopic data seem to indicate that *Metapenaeus monoceros* is slightly hypotonic to the external medium while it is in normal sea water but that there is pronounced hypertonicity in lower dilutions. These results have been checked with parallel studies on the retention of Chloride in various dilutions. The significance of these results on the distribution of these species and the general problems of osmoregulation is discussed.

7. Observations on the habits of Stomatopods.

K. H. ALIKUNHI, Madras.

Though one of the characteristic groups of the tropics, very little is known about the life habits of stomatopods. Observations on the larval, post-larval and adolescent forms of several species of the genera *Squilla* and *Lysiosquilla* were made in aquarium tanks at Madras.

Final pelagic larvae moult and metamorphose into post-larvae overnight in the laboratory. The exact process of moulting and the rapid assumption of post-larval features are fully discussed.

The transparent pelagic larva rarely has any chromatophores on the body. On metamorphosing into the post-larva chromatophores suddenly make their appearance and get distributed in characteristic patterns. If the larval eye stalks are cut off, the formation of chromatophores is arrested in the resulting blind post-larva, which consequently becomes an albino. Though blind such specimens also thrive in the aquarium and undergo regular moults.

Characteristic feeding habits of larval and post-larval forms are detailed in the paper. Cannibalistic tendencies predominate.

8. Note on the metamorphosis of Phyllosoma larvae from the Madras plankton.

K. H. ALIKUNHI, Madras.

Though not very common, Phyllosoma larvae form a conspicuous item of the macroplankton of the Madras coast, particularly during March. Early stages are remarkably few in the surface plankton, while the final pelagic stage predominates. Puerulus occurs only rarely.

As in the case of Stomatopods, the final pelagic larva metamorphoses into the post-larva, over-night in the laboratory. Early larvae also moult into later stages. The post larval specimens thrive in aquaria and grow by regular moults. The mechanisms of larval and post-larval moults are described in detail.

Larval and post-larval stage of two species of *Scyllarus* and a single species of *Panulirus* are dealt with in the present note.

Correlation of larvae with the adults on direct evidence of metamorphosis is being achieved for the first time in India in this economically important group of decapod crustaceans.

9. Observations on a copepod (*Caligus pterois* sp. nov.) parasitic on scorpion fish *Pterois russellii* (Van Hass).

C. V. KURIAN, Trivandrum.

Caligus pterois sp. nov. is an ectodermal parasite on scorpion fish (*Pterois russellii*). Attempts were made to induce the parasite on other fishes without success, thus indicating its tendency for a specific host, as in other caligids. The parasite lives on the blood of the host and as such it is found to be detrimental to the host, especially when infection is severe.

A systematic study of the parasite shows that it is a new species which resembles *C. rufimaculatus* Wilson and *C. pageti* Russell in the general shape of the body, but it differs from both these in the structure of the appendages. The mandible is long and slender, having twelve small serrations on the curved inner edge towards the free end. The sternal fork consists of two blade-like processes directed backwards, which are connected at the bases by a narrow bridge. The fifth and sixth pairs of legs are visible dorsally as three small setae on each side at the postero-lateral corner of the genital segment. In male the abdomen is two-jointed, the distal one being three and a half times as long as the small proximal joint.

The reproductive organs of the parasite resembles those of caligids. The egg cases are long, containing about forty to fifty eggs in each string. The eggs are colourless at first but gradually become reddish-brown before it is liberated from the egg case. The embryo on extrusion from the egg case hatches out as a nauplius after about an hour. Two naupliar stages have been observed, the later stage being reached within 11-14 hrs. after the issue of the first nauplius. About 20 hrs. after hatching the copepodid stage is reached. It swims about in search of a suitable host and clings to it by the second antennae which are large and well-developed as clasping organs. After attachment it passes through four chalimus stage. In the last chalimus the sexes can be differentiated and in the male the reproductive organs are visible in the genital segment. At the next moult, the animal gets free from the frontal filament and attaches itself to the host by the lunules and the clasping organs.

10. Sex differences in four genera of copepods parasitic on Indian fishes.

P. C. GNANAMUTHU, Madras.

The difference in sex ratio observed among free living copepods is not so marked in forms with a confirmed parasitic habit. Differences in size noticeable among non-parasitic copepods is greatly exaggerated in the more degenerate parasitic forms like Lernaeopodidae, while it is not so marked in the less specialised families like Caligidae. The parasitic males possess not only the prehensile organs characteristic of the species but also special devices for attachment to the females. The reduction in size of the male and greater development of organs of attachment are specially noted in *Bomolochus multisponsa* and *Clavellisa dussumieria*, in which the males are diminutive in size and are attached to the females even after fertilisation. The sex dimorphism of these forms, as well as those of *Lernanthropus dussumieria* and *Caligus polycanthi* are discussed in detail. The sex differences in the Dichelesthid *Lernanthropus*, cannot be explained as due to parasitism as such but rather as accentuations of differences occurring in free living forms due to gonadal activity. The differences in Caligids appear even in so late larval stages. Sex differences in the parasitic forms, may be due to the males being attached to the females and therefore being less motile, and not because of parasitic feeding, and also due to their sexual efflorescence while still at a low growth level.

11. On the occurrence of Crangonids (Crustacea, Caridea) in the coastal waters of Trivandrum.

C. V. KURIEN, Trivandrum.

The Crangonids are bottom dwelling Crustaceans generally found among sea weeds. Two species namely *Pontophilus hendersoni* Kemp, and *P. parvirostris* Kemp, were collected from the Trivandrum coast while investigating the bottom fauna within the fifteen fathom line. The former is represented in the present collection by a few specimens and the latter only by a single specimen.

Though *P. hendersoni* resembles the type specimen in the general shape and specific characters, certain remarkable differences have been observed in the structure of the appendages. The thumb of the sub-chela in the first peraeopod is about twice the length across its base and resembles that of *Philocheros megalochelir* Stebbing. The second peraeopod has the fingers more than double the length of the palm and the constrictions at the apices of the fingers are very indistinct. The size is comparatively large, being about double that of the specimens collected from the Chulka lake. It also possesses a remarkable colour pattern.

The affinity of *P. hendersoni* with *P. megalochelir* is only superficial; the latter can be easily differentiated by the distinctive characters of the appendages.

P. parvirostris also shows certain differences from the type specimen described by Kemp. The thumb of the sub-chela which is longer, the proportionate lengths of the joints of the first peraeopod differ and the sixth abdominal somite is slightly smaller than the telson.

12. On two new species of Crabs from Travancore.

N. KRISHNA PILLAI, Trivandrum.

This paper gives a brief account of two new species of crabs collected while investigating the crab fauna of the State.

Huenia. sp. nov. belongs to the sub-family Acanthonychinae in the family Maiidae. The species can be easily distinguished by the following characters. (1) In front of the gastric tubercle there are two additional dorsal tubercles. (2) The lateral expansions of the carapace are not so foliaceous as in *H. proteus*. (3) The rostrum instead of being simple and laterally compressed, shows a distinct flattening on its ventral side ending in a spoon shaped tip. (4) There is no distinct pre-ocular spine, but the presence of a supra-ocular ridge together with an ill developed pre-orbitary tooth gives the impression of an orbit. This species usually lives among weeds on the submerged rocks and boulders within tidal limits in south Travancore.

Macrophthalmus sp. nov. belongs to the sub family Scopimerinae of the family Ocypodidae. It differs from all known species of *Macrophthalmus* and according to the key given by Tesch (1915) it comes between *M. dilatatus* and *M. brevis* resembling the latter to some extent. It lives on the mud flats forming the shore of the back-waters in certain regions of the Ashtamudi and Vembanad lakes and is usually found along with *Gelasimus marionis* and *Dotilla mycteroides* and other inhabitants of the mud flats.

13. A collection of Pycnogonids from the Vizhinjam coast.

C. V. KURIEN. Trivandrum.

This paper describes four species of Pycnogonids collected from the Vizhinjam coast within the 15 fathom line, during a survey of the bottom fauna and bottom deposits of the region. Though previously pycnogonids have been obtained in the plankton collection (Meenam 1945), they are essentially bottom-dwelling animals, generally found among sea weeds. Of the four species in the present collection, *Parapallene kemp* Calman is the only common species the other three are either rare or only casual visitors in this locality.

Pallenopsis sp. resembles *P. alcocki* Calman and *P. crosslandi* Carpenter in general appearance, but it differs from both in the structure of the finger-like processes on the legs and the abdomen. Each process bears 4-5 small spines on its sides and free end in addition to the long spine at the tip.

The specimens of *Anoplodactylus cribellatus* Calman, differ from the type in having the second coxa of the third leg slightly shorter than the first and the third joints together, and in having the basal projection on the propodus not strongly marked.

P. kemp is previously known from the Orissa coast, Gulf of Mannar and Waltair and *A. cribellatus* from Andamans. *A. petiolatus* has been hitherto collected only from the European coast, Mediterranean and Pacific and is recorded from Indian water for the first time.

14. Anopheles breeding in the rice-fields of lower Bengal.

P. SEN, Calcutta.

Eleven species *A. hyrcanus* var *nigerrimus*, *A. barbirostris*, *A. annularis*, *A. ramsayi*, *A. pallidus*, *A. philippinensis*, *A. tessellatus*, *A. varuna*, *A. aconitus*, *A. vagus* and *A. subpictus*, were found to breed in the cultivated rice fields. Turbidity had no adverse effect on the last two species which were practically the only anophelines that bred in fallow fields.

A. hyrcanus and *A. annularis* appeared in the rice fields with the introduction of Seedlings, but they bred more intensively towards the close of the season when the water had stagnated.

A. pallidus, *A. philippinensis* and *A. varuna* although of low prevalence, indicated preference for breeding in fields with tall plants usually 1' in height when the water was clear.

The maximum amount of breeding in the rice-fields was noticed at 2" to 6" column of water, diminishing gradually after this.

The only important vector species in the area *A. philippinensis* although of very low prevalence being below one per cent of the total catch in larval stage, was recorded

from a range of $\frac{1}{2}$ " to 1'6" of clear water when the plants had grown 1' to 2' tall; *A. varuna* required a larger volume, the minimum being 1" and maximum 2'.

From 1' to 2' tall plants gave the best range for the development of the various anopheline larvae; and beyond 2'6" stage of rice plant the important species became scarce.

15. Ecological studies on *Odontotermes redemanni* Wasmann.

D. MUKERJI and PRABHAS KUMAR MITRA, Calcutta.

Situations of the nests and infestations by this species have been studied. The range of pH of the fields infested by this species, in the dam areas of Mithon (Barakar), is from 6.4 to 7.0, the average being 6.6. The structure of the termitarium with special reference to the fungus-combs has been studied. The pH of the fungus-combs varies from 3.9 to 4.3, the average being 4.06. The relative proportion of the soldiers, workers and immature forms calculated roughly, indicated the ratio to be 1:6:33. The colonising activities of this species has been studied.

16. Post-embryonic development of antenna of *Bagrada picta* Fab.

S. S. SAXENA, Gwalior.

Almost all the members of the family Pentatomidae (Hemiptera-Heteroptera) possess five-jointed antennae; similarly *Bagrada picta* Fab. also has five-jointed antennae in the adult stage. But during the nymphal stages the antennae remain four-jointed. It has been seen that during the nymphal stages the pedicel continues to elongate much more rapidly than other segments of the antenna, but in the adult stage it becomes shortened, while segments continue to elongate as in the previous stages. The natural inference would be that the pedicel becomes divided into two segments and thus becomes shortened. In fact it actually happens, viz., a new segment appears in the adult stage and thus the antenna becomes five-jointed which was so far four-jointed.

Hence it may be concluded that in *B. picta* Fab., it is the pedicel only which divides and thus a new segment is added to the antenna.

Now it can be generalised that wherever there is an increase in the antennal segment it is only the pedicel which divides.

17. On the Occurrence of an interesting species of Shrimp-fish (Centriscidae) from Travancore Coast.

S. NATARAJ, Trivandrum

In March 1947 three collections of Shrimp-fish were obtained in the *Nonnavu madi*, a close meshed shore seine net used periodically for the fishing of post-larval forms of fish, Crustaceans and Cephalopods. The collection is particularly interesting because it represents a hitherto undescribed species of Shrimp-fish belonging to the genus *Centriscus* and because this is the first record of the occurrence of any species of this genus from the Travancore coast.

So far only two species of *Centriscus* are known from the Indo-Australian waters (Weber and Beaufort 1942) viz. *C. scutatus* L. and *C. cristatus* (De Vis). Of these the former appears to be a more common species since it has been recorded from different places in the Indian Ocean other than the West coast of India, while the latter is restricted more to the Australian than Indian seas.

The present examples differ from the above two species in a number of characters, the chief of them being the presence of a small strong hook which originates a little distance below the tip of the backwardly directed dorsal spine and the presence of a pair of small curved sharp spines from the anterior end of the lower lip. These characters are not found in any known Indo-Australian species of the family Centriscidae. A detailed account of the species is under preparation.

18. The Molluscan Fauna and the Lime Shell Resources of Travancore.

K. PARAMESWARAN PILLAI, Trivandrum

The present paper is based on an extensive collection of shells from the different backwaters of the State and from the sea coast. The collection includes forty-five species of Lamellibranchiata belonging to twenty-seven genera and eighty-two species of Gastro-

poda belonging to forty-two genera. Of this large collection only three genera of Lamelli-branchiata constitute the main source of lime (calcium carbonate). *Meretrix* and *Velorita* are the chief groups represented in the backwaters where they form extensive clam beds and rich subsoil deposits. *Arca granosa* shells are also found in the subsoil clay in the south eastern part of the Vembanad Lake. Large quantities of miscellaneous shells are drifted ashore during the south west monsoon by the strong south-easterly current which strikes the coast of Munampam, Kayamkulam and Quilon.

An attempt has been made to study the bionomics and distribution of the important species and also to determine the calcium content of the representative types. It has been found that the percentage of calcium carbonate in *Arca granosa* and *Velorita cornucopia* is 93.35 and 94.8 respectively while that of *Ostrea madrasensis* is only 91.50. This is probably the reason why the shells of *Ostrea* are not used for the manufacture of lime though they are plentiful in some of the back waters.

19. A further note on the Breeding, Parasitism and Development of the Indian Freshwater Mussels.

R. V. SESHAIYA, Annamalainagar.

Lamellidens marginalis attains sexual maturity when it is just over two years old, whereas the European freshwater mussel *Anodonta* does not attain sexual maturity till the fifth year of its life. Species of *Lamellidens* seems to have two principal breeding seasons. Gravid females with ripe glochidia in the gills are abundant in the months of July & August, and again in December, January and February. But stray instances of gravid females are occasionally met with in other months. During the summer months, when the ponds dry up, the fresh water mussels burrow into the deeper layers of the mud. Such aestivating mussels include gravid females, i.e., with developing eggs in their marsupia. The following fishes have been experimentally found to be suitable hosts for the glochidia of all the common freshwater mussels :—

- | | |
|------------------------------------|-----------------------------------|
| 1. <i>Ophicephalus striatus</i> , | 2. <i>Ophicephalus gachua</i> , |
| 3. <i>Ophicephalus punctatus</i> , | 4. <i>Macrones vittatus</i> , |
| 5. <i>Anabas testudineus</i> , | 6. <i>Etroplus maculatus</i> , |
| 7. <i>Rhynchobdella aculeata</i> , | 8. <i>Notopterus notopterus</i> , |
| 9. <i>Glossogobius giuris</i> , | 10. <i>Anguilla bengalensis</i> . |

Exotic fish like *Gambusia* were also found to be suitable hosts for the glochidia. After repeated infections (Usually five or six) the fish acquire immunity, and the encysted glochidia fail to metamorphose. Natural immunity is possessed by some fish like *Aplocheilichthys* and species of *Barbus*. The sequence of organogeny during the parasitic period which is three days in the hot season and six to eight days in the cold season is briefly described.

20. On a collection of Scaphopods (Mollusca) from the Travancore coast.

C. V. KURIAN, Trivandrum.

The paper deals with a collection of scaphopods obtained on a survey of the Bottom Fauna and Bottom Deposits of the Travancore Coast within the 15 fathom line. *Dentalium cancellatum* and *D. paucicinctum* are represented by solitary specimens from Alleppey at 12 faths. and from Trivandrum at 15 faths. respectively, while *D. quadruplicale* has been obtained sparingly from Trivandrum and Cape Comorin regions. The specimen of *Dentalium* collected, range from 11.9—50 mm. in length. The genus *Cadulus* is represented by a single species, namely *C. longilobatus* which is common at Trivandrum in a deposit formed of black sand with a small percentage of mud and shell fragments, and swarms occur towards the 15 fathom line during February and March.

Of the four species dealt with, only *D. quadruplicale* has been previously recorded from this Coast and that by the Siboga Expedition from a depth of 406 fathoms.

The systematics and distribution of all the species collected are given.

21. The rate of Growth of *Cerithidea cingulatus* Gmelin (Gastropoda Pectinibranchia).

V. SADASIVAN, Madras.

In this paper an attempt is made to study the rate of growth, the duration of the breeding period and the age at maturity of *Cerithidea cingulatus* Gmelin, the common gastropod of the backwaters at Madras. With the data of length measurements of samples of population collected every month, the animals were grouped according to the different size groups. Size frequency curves were drawn for all the months and the rate of growth followed. The rate of growth in the young shells belonging to 1945 generation, as indicated by the growth curves, is 1.17mm. per month; i.e. shells which were 4 mm. in the month of May '45 were 22 mm. by December '46 within a period of 19 months. Rearing experiments performed in the Laboratory with young shells measuring 4 mm. showed the same rate of growth as recorded from field observations. Growth seems to cease with the 22 mm. size group. The adult characters of the elevated body whorl and the expanded and everted lip are acquired after one year. Growth in the older shells belonging to the second and third years is very slow and it was found by rearing experiments in the Laboratory to be 0.17 mm. per month. The animals attain sexual maturity when they reach the 18 mm. size and, it is estimated, in about 2½ years after the young ones settle down. Breeding season begins in the month of January and extends till the end of June with a pronounced peak in the month of March.

22. A preliminary report on the Cephalopods of Baroda.

S. T. MOSES, Baroda.

Introduction.—Ammonites as 'Saligrams'—*Nautilus pompilius* shells 2 obtained—Shells of *Spirula* prototypus common—Cuttlebones the 'Samudraphen'. Cuttlebone lease and trade.—The edible Cephalopods *Sepia* and *Loligo*—Check list of species of Cephalopods (1 *Sepiolo*, 3 of *Loligo*, 1 *Euploteuthis*, 5 of *Sepia* and 6 of *Octopus*).

23. A preliminary account of the marine planktonic Diatoms of the Trivandrum coast.

P. V. RAMACHANDRAN NAIR, Trivandrum.

The coastal waters of Travancore are rich in planktonic Diatoms during certain seasons of the year, and hitherto forty-one species have been recorded by M.A.S. Menon (Proc. Ind. Sci., XXII, 2. 1945 pp. 36-38). During the present investigations seventy-one species belonging to fourteen families and twenty-nine genera have been collected. Of these sixty-one species have already been described from the Madras coast by Subramanyam R. (Proc. Ind. Acad. Sci., XXIV. 4. 1946) while the remaining ten species namely, *Hyalodiscus stelliger* Bailey, *Rhizosolenia shrubsolei* Cleve, *R. bergonii* H. Perags *Chaetoceros pseudocrinitus*, Ostenfeld, *C. borealis* Bailey, *C. brevis* Schutt, *C. sericanthus*, Gran, *C. compressus* Lauder, *Triceratium*(sp) and *Fragilaria striatula* Lynbys, are recorded from the Indian coast for the first time. The dominant families of Diatoms in this coast are *Chaetoceros*, *Bidulphia*, *Rhizosolenia* and *Coscinodiscus* while the other families are comparatively rare and are only found occasionally in plankton collections.

A quantitative study of the Diatoms in relation to the phosphate and nitrate contents of sea water and other hydrographical factors is in progress.

24. Limnology of the Mukerti Reservoir, Nilgiris. I Summer Conditions.

FRANCESCA THIVY, S. V. GANAPATI and K. H. ALIKUNHI, Madras.

The Mukerti Reservoir, situated at an altitude of over 8000 feet, is formed by damming up of the Mukerti river and has a water-spread area of about a square mile with a maximum depth of 84 feet. The exotic Rainbow Trout is the only important food fish stocked in this reservoir.

A hydrobiological study of the reservoir was carried out in March, 1947.

Water is pure, soft and rich bottle green in colour, with good depth of visibility. Temperature ranges from 18.1° C at the surface to 15.7° C. at a depth of 68 feet. pH. varies with depth from 6.3 to 5.9. Water and plankton samples collected from fixed depths reveal the presence of dissolved oxygen only up to 59 feet from the surface.

Marginal vegetation is formed by a dense growth of the dominant species of the 'down flora', i.e., the grass *Cymbopogon polyneuros* Stapf. Phytoplankton is represented by a variety of species of desmids and diatoms. Zooplankton is comparatively poor, copepods and rotifers forming the main constituents.

The reservoir is oligotrophic in character and contains the Caledonian type of phytoplankton.

25. Hydrobiological investigation of the Stanley Reservoir at Mettur, Madras.

S. V. GANAPATI, K. H. ALIKUNHI, and FRANCESCA THIVY, Madras.

A preliminary hydrobiological survey of the Stanley reservoir and the Cauvery river at Mettur was for the first time made under summer conditions in June, 1947.

The reservoir level was 94 feet. Water samples were collected from the surface as well as from 34 and 94 feet levels and analysed. Experimental fishing at particular depths revealed that no fish frequented the 40 feet level and below. While the surface water was green in colour and rich in dissolved oxygen with a pH. of 8.5, at 34 feet level dissolved oxygen was nil, pH. 7.5 and sulphuretted hydrogen 1.423 mg/l. In the deeper layers the concentration of this gas increased. However, the black malodorous water issuing out of the tail-race of the Mettur Power House as also the water trickling down the high and low level sluices contained sufficient dissolved oxygen and had only traces of sulphuretted hydrogen, smelling strongly of the same. Sulphur bacteria (*Thiothrix nivea*) were thriving luxuriantly all along the course of the discoloured water and fishes like *Labeo kontius*, *Barbus carnaticus*, *Cirrhina* sp. *Danio*, and *Discongnathus* were observed breeding in the area.

The lentic conditions prevailing in the reservoir consequent on the damming of the river facilitate thermal stratification during summer months. Under anaerobic conditions in the lower layers sulphate reduction takes place resulting in the formation of hydrogen sulphide. The accumulation of this gas appears to render over 2/3 of the reservoir uninhabitable for fish. Even before becoming lotic in character the lower layers of water gushing through the sluices get aerated and rendered suitable for both fish and plant life.

26. On the Ecology of two temple tanks at Coimbatore, Madras.

FRANCESCA THIVY, S. V. GANAPATI, and K. H. ALIKUNHI, Madras.

Utilisation of religious institutional waters for fish culture is being actively pursued in Madras, and the elucidation of the ecology of this characteristic type of waters is of immediate practical importance. Observations on two such tanks at Coimbatore carried out in July, 1947 are detailed in the present communication.

	VENUGOPALSWAMI TANK.	ANJENEYASWAMI TANK.
Colour of water	Yellowish brown.	Yellowish green.
Depth	13 feet.	10 feet.
Temperature	28.4 to 29.5°C.	26.5 to 28.0°C.
pH.	8.05 to 8.50	8.08 to 8.30
D.O., cc/L.	1.675 to 4.188	1.256 to 4.328
Free CO ₂	NIL	NIL
Chloride	9.2 parts per 100,000	9.7 parts per 100,000
Macrovegetation	NIL	NIL
Phytoplankton	Chlorococcales dominant, fewer Blue-greens, diatoms, flagellates & Dinophyceae.	Identical
Zooplankton.	Copepods & Rotifers dominant.	Rotifers dominant.
Fish stocked.	<i>Gourami</i> , <i>Chanos</i> , <i>Calla</i> , <i>Cirrhina reba</i> .	<i>Gourami</i> , <i>Chanos</i> , <i>Etiopius</i> , <i>Barbus hexagonolepis</i> .

Diurnal variations in the two ponds are discussed on the basis of six-hourly observations.

An almost permanent algal bloom is characteristic of the majority of temple tanks. Fish food in such tanks is obviously abundant.

27. On the Ecology of two spring ponds at Conjeevaram, Madras.

S. V. GANAPATI, Francesca Thivy and K. H. ALIKUNHI, Madras.

The village spring ponds at Rajampet and Muthialpet in Conjeevaram were surveyed in June, 1947. Situated in the midst of arid sandy region, the ponds are fed by deep perennial springs. During the rainy season they get connected to the river Palar.

Local carps, murels, gobies, catfishes and minnows constituted the existing natural fishery in these ponds.

Conditions of existence during summer were as follows :

Pond.	Depth at the centre.	Colour.	Temperature.	pH.	Dissolved O ₂	Free CO ₂ .	Chlorides.
Rajampet. ..	4 ft.	dark green.	30.1—31.5°C.	7.1	4 to 6 cc/L.	0.80-0.9 parts per 100,000	17 parts per 100,000
Muthialpet. ..	5 ft.	Bluish.	32.4—32.8°C.	7.5	5.2-7.2 cc/L.	0.37-0.59 parts per 100,000	32 parts per 100,000

Hydrophytes are abundant in both the ponds. Several green and blue green algae are present in the phytoplankton, while the absence of planktonic crustacea is characteristic of the zooplankton.

The perennial springs, low free carbon-di-oxide, high Oxygen content, gently flowing water, absence of planktonic crustacea, etc., constitute important ecological traits which make the ponds a type by themselves, offering scope for pisciculture.

28. Limnology of the Ootacamund Lake, Nilgiris : II. Summer Conditions.

K. H. ALIKUNHI, S. V. GANAPATI and FRANCESCA THIVY, Madras.

A detailed limnological survey of the Ootacamund lake was conducted in March, 1947.

Over seventy acres in area and situated at an altitude of about 7000 feet, the lake is now stocked with exotic species like Tench, English carp, and varieties of *Cyprinus carpio*, besides indigenous species of minnows, loaches and barils.

The bottom configuration was charted by taking soundings at 259 points. Maximum depth was 30.6 feet. Water and plankton samples were collected from fixed depths at different stations. Diurnal variations in the hydrobiological complex occurring in different layers were investigated at six-hourly intervals. A representative collection of the macrofauna and flora has been made. The rich hydrophytic and halophytic associations were plotted in detail. Bottom deposits from different sections were studied.

A pronounced thermal stratification and the co-existing conditions of summer stagnation prevailed in the lake. Dissolved oxygen extended to a maximum depth of 20 feet. Deeper layers were devoid of oxygen but were surcharged with sulphuretted hydrogen. pH. varied from 6.5 at the bottom to 8.7 at surface. Temperature steadily diminished with depth, from 21.6 to 15.3°C.

Aquatic oligochaetes were present in the oxygenless bottom mud.

Phytoplankton consisted almost exclusively of a dense swarm of *Ceratium hirundinella* which imparted a dirty brown colour to the water. Zooplankton was rich in species and numbers, Cladocerans, Copepods and rotifers predominating. Plankton was absent in the oxygenless zone.

The lake is essentially eutrophic in character. However, the oxygenless zone considerably restricts the effective space for fish life and productivity.

29. Utilisation of Fire Service Tanks for Fish Rearing.

P. I. CHACKO, Madras.

The concrete static tanks intended for fire-fighting purpose, are used for nursing and distributing fish-seed, for stocking larvicides, and for fish production and marketing in Madras. A static tank of 150,000 gallons capacity in Madras City was stocked with 75

fry of *Labeo rohita*, 3500 of *Catla catla*, 10 of *Gourami*, and of 100 *Etrophus suratensis*, and with 500 *Gambusia affinis* in July-August 1946. Water plants were planted, and manuring was also done. The plankton of the tank consisted of *Anabaenopsis*, *Ceratoceros*, *Closterium*, *Copepods*, *Cyclotella*, *Euglena*, *Lyngbia*, *Melosira*, *Microcystis*, *Navicula*, *Oscillatoria*, *Pandorina*, *Phacus*, *Rotifer*, *Spirulina*, *Synedra*, *Surirella*, *Volvox* and Vorticellid colonies. In November 1946, 3000 *Catla*, 8-10 inches in size, were removed for stocking other waters. In January 1947, 20 Rohu, 12-14 inches, were also removed for the same purpose. 34 Rohu, 14-18 inches and 2-3 lbs, were netted and marketed in June 1947. *Gourami* (9-12") and *Etrophus* (4-6") were collected and stocked in another breeding pond. The static tank was then cleaned, dried and refilled in July. During cleaning, one *Geoemyda trijuga* and one *Anguilla bengalensis* (36" and 3 lbs) were removed. The stomach of the latter contained fish remains and algal matter.

30. An Investigation into the Food and Feeding Habits of some of the common Freshwater Fishes of Madras.

K. H. ALIKUNHI and S. NAGARAJA RAO, Madras.

The suitability of a fish for culture largely depends on its food and feeding habits. During an investigation aimed at ascertaining the relative importance for cultural purposes, of the different species of freshwater fishes of Madras, the food and feeding habits of the majority of them were elucidated. Data on the systematic analysis of the gut contents of *Cirrhina cirrhosa*, *Mystus seenghala*, *Pangasius pangasius*, *Silonia silonia*, *Megalops cyprinoides*, *Elops indicus*, *Notopterus notopterus*, *Anabas testudineus* and *Ophi cephalus punctatus* are furnished in the present paper.

The strictly freshwater specimens of *P. pangasius* feed largely on gastropods and insects. *S. silonia* shows marked piscivorous tendencies. *M. Seenghala* takes in quantities of gastropods but is decidedly piscivorous also. Fingerlings of *M. cyprinoides* and *E. indicus*, naturally acclimatised to freshwater, feed largely on mysids and other crustacea, but have no predilection for cyclops. Insects and ostracods predominate in the gut contents of the climbing perch. Quantities of vegetable matter are also generally taken in. *N. notopterus* and *O. punctatus* are predominantly insectivorous, and hence not destructive to other fisheries in any large measure. Plankton feeding and nibbling at algal growth are indicated in *C. cirrhosa*, the most important carp of the Cauvery.

31. On the Bionomics, Feeding Habits and Breeding of 'Karambai' *Barbus* (*Lissochilus*) *hexagonolepis* MacClelland in the River Cauvery, Madras.

K. H. ALIKUNHI, Madras.

Barbus (*Lissochilus*) *hexagonolepis* abounds in the Assam-Himalayan rivers. So far, it is not known to occur in peninsular India. Specimens of this mahseer, locally called 'KARAMBI', are however, common in the river Cauvery. The South Indian Specimens are of a bluish colour and in the general build of the body, very much resemble the 'Olive Mahseer' of the Pegu district. Specimens over two feet in length and 10 pounds in weight are not uncommon in the Mettur—Bhavani stretch of the Cauvery.

Karambai is a voracious feeder. Length of gut varies from 2.5 to 5 times the total length. Intestine is usually gorged with marginal grass, aquatic weeds, gastropod shells and insect parts.

Breeding in the Cauvery corresponds with the monsoon months, and 1-2" long fingerlings are available in large numbers during February-March and June-July. Natural seed nurseries are being exploited for stocking lentic waters. Growth in the latter is, however, slow.

32. Fisheries of the Manjra River

M. RAHIMULLAH, Hyderabad-Deccan.

Observations on the breeding habits of the carps and cat-fishes are in progress and it has been found that during the rainy season, i.e., June to August, the ratio of the catch of carps to cat-fishes was 85:15 in 1946 but in 1947 it was 93:7. The cat-fishes are plentiful in the deep pools during other seasons but the carps are very few.

It is due to the difference in the breeding habits of these two types of fishes because the cat-fishes breed even in impounded water and in tanks but the carps breed only during the rainy season when the rivers are in spate.

A peculiarity about *Catla* is that it is not found in the river at other seasons than the rains and takes shelter in the reservoir. It has not been reported above the Ghanpoor Anicut nor down Nizam-sagar reservoir in the stream although it is caught in fairly large numbers in the Godavari river of which the Manjra is a tributary.

Further investigations down the reservoir are under progress to find out the factors governing the breeding habits of *Catla*.

33. Life History of the Scale Carp *Cyprinus carpio* var *communis*, (Linn.).

A. R. K. ZOBAIRI and N.V. CHOODAMANI, Ootacamund.

The Scale carp, *cyprinus carpio* var *communis*, is one of the three varieties of the German Carp popularly known as the *MIRROR CARP*, introduced in the Nilgiris in the year 1939 from Nuwara Eliya, Ceylon; the three varieties differing among themselves only in the matter of their scaling. The life history of this carp was studied by stripping and artificially fecundating its ova and correlating the various stages in development with those of the contemporary eggs obtained from the Wilson Fish Farm and the lake at Ootacamund, Nilgiris.

Breeding Season : The Scale Carp, as also the other two of its varieties are found to breed all the year round in the Nilgiris except during the South West Monsoon months JUNE-SEPTEMBER; JANUARY-APRIL being the peak period of breeding.

Breeding Habits : Distinct spawning groups are met with consisting of one large spawner and three to five small milners. The spawn is shed by violent muscular contractions of the body and fertilised in water. Eggs are demersal and adhesive settling on aquatic weeds. The Scale Carp has an incredible fecundity.

Fertilised Egg : Spherical with a glassy vacuolated yolk and dilated with a distinct perivitelline space. It has an average diameter of 1.3 mm.

Development : Dilation of the egg begins three minutes after and is completed about ten minutes after fertilisation. Formative protoplasm appears one hour after fertilisation. First cleavage starts sixty-two minutes after fertilisation. Segmentation is meroblastic and unequal. The blastoderm invades the yolk upto its equator and the embryonic ridge is differentiated eight hours; blastoderm envelops the yolk completely leaving a blastopore and an embryo with 12 somites is differentiated eight and half hours, a well defined embryo with 33 somites develops sixty-nine hours, after fertilisation. First hatching takes place seventy-two and a half hours after fertilisation and continues upto seventy three hours in water varying in temperature between 20°C-23.5° C.

The newly hatched larva averages 2.5 mm in length with no mouth, alimentary canal, anus or gills. Notochord is cellular. Heart is seen pumping colourless blood about 82 times per minute. Mouth and anus open and the larva begins to feed and respire on the third day after hatching. It is carnivorous to start with feeding voraciously on *Daphnia* sp.

Scales make their first appearance on the forty fourth day after hatching. The larva completes its postembryonic metamorphosis and becomes a replica of its parents fifty-first day after hatching when it measures 3.5 cm. and 0.8 cm. in length and height respectively.

34. Food, Feeding Habits and rate of Growth of the Mirror Carp, *Cyprinus carpio* (Linn.).

A. R. K. ZOBAIRI and N. V. CHOODAMANI, Ootacamund.

Many fantastic stories relating to the gustatory propensities of the Mirror Carp are current, particularly in the West, which have rendered the usefulness or abnoxiousness of this carp a controversial matter. Since its introduction in the Nilgiris (1939) the Mirror Carp is found to be the best food fish, ideally suited for culture in the fallow highland waters. A comprehensive knowledge of its bionomics is therefore essential. While giving an account of the food, feeding habits and the rate of growth of this fish in this paper an attempt has been made to examine the various charges levelled against it.

The mouth of the Mirror Carp is devoid of teeth and is essentially suctional. A complex armature of pharyngeal teeth exists in its throat. The adult mirror Carp is an omnivorous creature with predilections more towards vegetarianism. It is a typical plankton feeder in addition, and is neither carnivorous nor predaceous.

The Mirror Carp larva commences alimentation when it is about 7.0 m.m. long and is carnivorous upto 4.7 c.m. At 5.5 cm. it begins to take diatoms and desmids in addition. The proportion of animal and vegetable matter at this stage is almost fifty fifty. The vegetable matter increases in proportion at 6.3 cm and beyond.

The roiliness of water caused by the Mirror Carp by its thrashing about at the bottom is not found to be injurious to either fish or to the growth of plankton. The aquatic vegetation is not destroyed in its entirety by this Carp.

The rate of growth of the Mirror Carp is directly proportional to the quantity of food available. It grows at the rate of 2.5 cm to 4.2 cm per month in the Wilson Fish Farm and the lake at Ootacamund, where the natural food of the carp is abundant. It is a very hardy fish, capable of enduring every adverse condition admirably. It lives for several hours out of water and is alive and active even after severe mutilations.

35. Preliminary Investigations on the Food of Trout in the Nilgiri Streams.

N. V. CHOODAMANI, G. LAKSHMINARAYANA RAO, V. RANGANATHAN,
and A. R. K. ZOBAIRI, Ootacamund,

The Trout introduced successfully in the Nilgiris in the year 1907 is an acclaimed favourite amongst the anglers as elsewhere, but the successive deterioration in its size has been the chief concern of its well wishers. Investigations into the causes of this are systematically being carried out and the present article deals with the results of work done in this direction, which is of a preliminary nature.

The knowledge of the kind and amount of food in each river and lake available for the Trout as well as of the quality and relative quantity of the items of its menu is important for any intelligent management and improvement of Trout fisheries. This could be acquired by a comprehensive analysis of the stomach contents of Trout correlated with an exhaustive biological survey of the waters. The paper deals with the results of the preliminary investigations of such a type of work on the Trout in the Nilgiris and its hill streams.

The eight waters out of about sixteen rivers, streams and lakes now populated by Trout on the Nilgiris selected for investigation are listed. The data on the quantitative analysis of over 120 samples of gut contents are tabulated. The different items of the food come across in the contents of the stomach are arranged in the order of their relative abundance. It is seen that insects constitute the bulk of the Trouts' dietary. Hence the biological survey of the waters were made with special reference to the riparian and aquatic insects and their under-water stages. The different species of the various orders of Insects met with in the streams have been identified as far as possible and described. 4 genera of Caddis flies (Trichoptera), 2 of May flies (*Ephemeroptera*), a solitary genus of Stone flies (*Plecoptera*), 4 aquatic and 3 terrestrial genera of Beetles (*Coloptera*), 2 of water bugs (*Hemiptera*), 2 of True flies (*Diptera*), have been represented in the streams, either by their larval and nymphal stages or adult forms. Larval forms of the genus *Chironomus* (the midges) and *Eriocera* (Crane fly) have also been noted. The Black ant' of the fly-fisherman is a non-aquatic *Hymenoptera* belonging to the family *Formicidae* haunting marginal trees, wherefrom they are dislodged by wind into the streams. *Crustacea* are represented by Carbs, the fairy shrimps, and the non-indigenous shrimp, *Cardina* sp. Molluscs are represented only by a thick-shelled Gastropod *Neritina* sp., and a species of limpets belonging to the genus *Paludonius*. Earthworms have been noticed to form the exclusive food of Trout on certain occasions during the monsoon. The Minnows, *Danio* sp. form the undesirable aliens into Trout waters.

From the above study it is concluded that the Nilgiri Trout is entirely carnivorous. The sufficiency of the food available in the streams is discussed. It is found that the Trout are not underfed. The comparative seasonal abundance of surface and submerged fauna and the influence of floods on the same are also discussed. Conclusive observations in this respect are much desired for proscribing angling seasons with a view to improve the quality of the fishing.

36. On the nutrition of the young stage of Certain Freshwater Fishes of Madras.

P. I. CHACKO and S. V. JOB, Madras.

The food of the fry of 17 species of fresh water fishes of Madras were investigated, with the following salient features. (1) *Barbus tor* : Algal filaments, *Pleurosigma*, *Pinnularia*, *Coscinodiscus* and particles. (2) *B. carnaticus* : insect remains, algal matter and sand grains. (3) *B. hexagonolepis* : algal matter, *Pinnularia*, *Pleurosigma*, *Fragillaria* and *Gomphonema*. (4) *B. curcuma* : insect remains. (5) *Cirrhhina reba* : *Oscillatoria*, *Lynobia*, *Rhizoclonium*, insect life, daphnids, *Navicula*, *Pinnularia* and *Tabellaria*. (6) *C. cirrhosa* : algal matter, *Mastogloia*, *Eunotia* and sand grains. (7) *C. fulunjee* : *Hydrilla*, *Closterium* and *Pleurosigma*. (8) *Labeo fimbriatus* : *Closterium*, *Coscinodiscus*, *Cyclotella*, *Fragillaria*, *Navicula*, insect remains, copepods, daphnids and sand particles. (9) *L. calbasu* : *Anomoeneis*, *Mastogloia*, *Spirogyra*, copepods and rotifers. (10) *Silundia sykesii* : water beetles and sand. (11) *Callichrous bimaculatus* : fish remains, insect remains and sand. (12) *Macrones gulio* : fish remains, insect remains, fish eggs, *Closterium*, *Fragillaria* and sand. (13) *M. cavasius* : insect remains and fish scales. (14) *M. seenghala* : *Spirogyra*, *Oscillatoria*, *Navicula* and *Pinnularia*. (15) *Bagarius bagarius* : young prawns, fish remains and sand. (16) *Glyptothorax lonah* : insect remains, algal matter and sand particles. (17) *Wallagonia attu* : fish larvae, *Closterium*, *Fragillaria* and algal filaments. The young stages of these species, are owing to their habit of feeding on insect life, useful as mosquito-larvae destroyers.

37. A Case of 'Gas Disease' in *Catla catla* (Hamilton).

P. I. CHACKO and S. V. JOB, Madras.

The cause for a case of heavy mortality that occurred in July 1947, among the population of *Catla*, 10-12 inches in size, in a Municipal pond in Madura, was diagnosed as Gas Disease by the following symptoms : (1) ragged and tattered appearance, (2) scales fallen off in round patches at the base of the dorsal, pectoral and ventral fins, (3) skin peeling off on touch, (4) loss of blood through the skin, (5) presence of gas bubbles in gill filaments, heart and blood vessels, (6) presence of gas bubbles in the gut which contained the normal items of food of the fish, and (7) air bladder highly distended and filling the visceral cavity by bursting through the peritoneum. Bacteria were not concerned with this disease. The immediate cause of death was asphyxiation from gas, embolism in the gill filaments and heart. Aeration of the pond water by dragging a net across for over two hours gave satisfactory results, and about 25% of the fishery was saved.

38. A Preliminary Note on the Hilsa Fishery Investigations in South India.

P. I. CHACKO and B. KRISHNAMURTHI, Madras.

In South India, *Hilsa ilisha* (Hamilton) occurs in the coastal waters from Vizagapatnam to the Palk Bay. The fish is rare in the Gulf of Manar and the West Coast. During the flood season it shoals into the rivers up to the first anicuts. This shoaling is more in the early hours (2-6 A.M.) of the days during the New Moon period. The spawners do not feed. The males reach the spawning grounds earlier. The left testis is larger. The fertilised egg is drifted into the tidal area, where development and hatching occurs. The fry move about in association with those of *Chatoessus chacunda* (Hamilton). The fish spends the first two years of its life in the tidal zone, feeding on planktonic organisms. It then moves into the 3-8 fathoms limits of the coastal sea. The Hilsa fisheries have recently declined owing to the construction of dams and anicuts and the consequent moderation of floods. There is also destructive fishing of spawners and young ones. A detailed investigation is being conducted.

39. Development of Fisheries of the Periyar Lake.

P. I. CHACKO, Madras.

The Periyar Lake is 10.20 sq. miles in area, and is situated at an elevation of 2800 feet, surrounded by thick forests. As a programme for the development of its fishery, a survey of the indigenous fish fauna was made, and 29 species were listed. To improve the quality of the fishery, a consignment of the quick-growing carp, *Catla catla* (Hamilton) was brought from the Godavari and introduced into the lake for the first

time in October 1946. A consignment of the Milkfish, *Chanos chanos* (Forsk.) collected from the sea (salinity 17.49%) around Krusadai Island was also stocked in the lake in April 1947. The thriving and growth of these semi-exotic species in the lake are being watched with interest.

40. On a Fish Survey of the Cauvery, Madras.

P. I. CHACKO and G. K. KURIYAN, Madras.

The fluvial fishery of the entire Cauvery system within the Madras Presidency is under the control of the Fisheries Department. This river yields about 65% of the inland fishery revenue. During a survey of the river, 77 species have been listed. Species which form a special feature of the fish fauna are *Barbus heragonolepis*, McClell, *B. carnaticus* (Jerdon), *B. tor* (Hamilton), *Labeo ariza* (Hamilton), *L. boga* (Hamilton), *L. kontius* (Jerdon), *L. nigrescens* Day, *Cirrhina cirrhosa* (Bloch), *Osteochilus* (Kantaka) *brevadorsalis* Day and *O. nashi* Day. In pursuance of a programme of fishery development, the river was stocked with the upper Indian carp, *Catla catla* (Hamilton) from 1923 onwards. This fish has established itself and now forms a large portion of the river fishery. Other species introduced into the river are *Osphromenus gourami*, Lacep. *Etioplos suratensis* (Bloch), *Labeo rohita* (Hamilton), *Cirrhina mrigala* (Hamilton) and *Chanos chanos* (Forsk.). The first two species have bred and spread themselves in the river system. Location and exploitation of spawning and nursery areas is a regular annual feature. Destructive methods of fishing are prohibited; and congregation areas of migratory species below dams and anicuts are declared as sanctuaries.

41. On the Bionomics of the Larvivorous Fishes of Madras.

P. I. CHACKO and R. S. VENKATRAMAN, Madras.

The local distribution and densities, food and feeding habits, breeding grounds, seasons and habits, communal associations and larvivorous propensities of the following larvicidal fishes of Madras are detailed: *Aplocheilichthys lineatus*, *A. blochii*, *Amblypharyngodon mola*, *Ambassia nama*, *A. ranga*, *Barbus ticto*, *B. sophore*, *Barilius bendelisis*, *Chela argentea*, *Colisa fasciatus*, *Danio aequipinnatus*, *Esomus danrica*, *Etioplos maculatus*, *Gambusia affinis*, *Lebistes reticulatus*, *Macropodus cupanus*, *Oryzias melastigma*, *Perilampus atpar*, *Rasbora daniconius* and *Therapon jarbua*.

42. On the History and Transport of the Mirror Carp in Oxygen Container from Ootacamund (Nilgiris) to Kumaun Hills (United Provinces).

B. SUNDARA RAJ and R. P. CORNELIUS, Lucknow.

The mirror carp a native of China and extensively cultivated for centuries in Europe was introduced from Germany into the Ceylon waters in 1914 and thence into the waters of the Nilgiris in 1939 by the senior author. On the Nilgiris they have flourished and are now providing a valuable new fishery.

For the improvement of Kumaun water an attempt has been made to introduce this fish. A special oxygen carrier was designed by the senior author for the transport of fingerlings from Ootacamund to Kumaun hills by aeroplane. The carrier and its use are described. After testing the apparatus the junior author brought 60 fingerlings of mirror carp partly by train and partly by air (Madras to Delhi) without a single casualty which proves the efficiency of the carrier. This is the first time that the mirror carp has been introduced anywhere on the Himalayas. The fish are growing well in a reconditioned pond in the Bhowali trout hatchery. The aim of the paper is to record the introduction of this new fish to Himalayan waters and to bring to the notice of the persons interested this simple and handy carrier.

43. On the Bionomics, Development and the early Growth Rate of the Cauvery Carp, *Labeo Kontius* Day.

K. H. ALIKUNHI and S. NAGARAJA RAO, Madras.

One of the major carps, growing to about a foot and a half, *Labeo Kontius* is indigenous to the Cauvery system.

Systematic analysis of stomach contents revealed that diatoms and algal filaments predominated in the menu. Bits of leaves, insect and worm remains, copepods and rotifers were also taken in.

With the onset of the south west monsoon in June, specimens 12 to 14 inches long become sexually ripe. Developing eggs, drifting along, were collected from the Cauvery at Hogainakal in July, '46. Water was muddy; temperature 23.5°C. to 23.6°C.; pH. 7.5 to 7.8; percentage of saturation of dissolved oxygen, 84.5 to 98.4 and free carbon dioxide, 0.091 to 0.122 parts per 100.000.

Spawning takes place in the early morning hours. Fertilised egg is 3.5 to 4m. \pm in diameter, demersal and transparent. Yolk is finely granular and of a sky blue tinge. The period of incubation is about 27 to 30 hours. The hatchling, about 3 m.m. long is transparent. On the 4th day after hatching the larva begins feeding.

By rearing the larvae a complete series of postlarval stages has been obtained. Growth of fingerlings under natural and artificial conditions has been followed, the data gathered affording interesting comparison.

44. Observations on the growth of *Cyprinus Carpio* in Tropical Environment at the Chetput Fish Farm, Madras.

K. H. ALIKUNHI and S. NAGARAJA RAO, Madras.

The successful acclimatisation of advanced fingerlings of *Cyprinus carpio* to the tropical conditions at Madras has been reported by Alikunhi & Runganathan (1946). Subsequent experiments of transportation have fully demonstrated the hardiness and the easy adaptability of the species, even in the early fry stage, to sudden climatic changes.

Fed on live plankton and soaked oil cake, the fry thrived well in nursery tanks. Early growth rate of all the three varieties of *C. Carpio*, viz; *communis*, *specularis* and *nudus*, have been followed regularly, first at weekly, and later on, at fortnightly intervals, at the Chetput Fish Farm, Madras. Growth is more or less uniform in the three varieties. From the half inch fry stage the average fingerling size of 4 inches was attained in the course of 3 months in cement nurseries. Growth in natural ponds is much quicker.

45. Food, Feeding Habits and Growth of Fingerlings of the Fresh-water Shark *Wallagonia attu* (Bl. Schn.).

K. H. ALIKUNHI, Madras.

Analysis of the stomach contents of specimens from the Cauvery, Godavari, Krishna and Tungabhadra confirm the marked piscivorous tendencies already noted by earlier workers.

Pronounced cannibalistic leanings were observed in fingerlings kept in nursery tanks containing abundant forage fish.

Peculiar feeding habits like 'lying in wait' for the approaching prey and darting at it with unerring precision and lightning rapidity resulting in the shooting out into the air of the aggressor himself are described.

Provided with sufficient forage fish, quick growth averaging about 3.3 inches per month is recorded in fingerlings kept in small nursery tanks.

46. Influence of Temperature on the Rate of Embryonic Differentiation in *Rasbora daniconius*.

K. H. ALIKUNHI and G. LAKSHMINARAYANA RAO, Madras.

Intensive breeding of *Rasbora daniconius* was observed during November, soon after heavy monsoon rains, in Madras. In the Ootacamund lake ripe oozing specimens of the same species were plentiful during March and September.

Embryonic and larval development was followed at Madras from naturally fertilized eggs collected from farm ponds, while, at Ootacamund oozing specimens of either sex, caught from the Ootacamund lake, were stripped and the ova artificially impregnated.

The average temperature of water in Madras during November was 27.06°C at 9 A.M. and 28.44°C at 4 pm. The period of incubation lasted for about 86 hours and the larvae hatched out on the fourth day after fertilization. The embryonic differentiation was studied in detail.

The average temperature of water in the Ootacamund lake during September was 17.2°C. The period of incubation was very much prolonged and hatching took place on the 12th day, 267 hours after fertilization.

With a difference in temperature of about 11.2°C the rate of embryonic differentiation in Madras is thrice as quick as in Ootacamund.

The adaptability of the species to different thermal conditions is interesting.

47. Growth, Maturity, and Brood care in the Murrels *Ophicephalus striatus* and *O. punctatus*.

K. H. ALIKUNHI, Madras.

Murrel forms the bulk and mainstay of the tank fisheries in several districts in Madras and is generally considered excellent for eating.

Recent investigations of Mukherjee, Rahimullah and others have supplemented the pioneer observation on the bionomics and breeding of murrels made by Willey and Raj. Specific data on the growth, fattening and age at maturity of this important group are of practical significance in culture.

Embryonic and larval development of *O. striatus* were studied in the laboratory. Post-larval growth and fattening were followed in the natural pond by segregated rearing. Yearlings, 8—9 months old were found to have the gonads in the fourth stage indicating that they would be ready to breed during the coming north-east monsoon.

Analysis of the natural food of fry and fingerlings have been made; the variation in growth in response to the relative abundance of food are noted.

Disparity in size between sexes was always noted. Additional data on brood care are furnished.

48. Note on the Spawning of Carps in the River Thungabhadra in Response to 'off Season' Freshets.

S. V. GANAPATI and K. H. ALIKUNHI, Madras.

An instance of carp spawning observed in the river Thungabhadra at Sunkesula on 24-9-46 is discussed.

Water level in the river was low. There were heavy rains in the evening on 23-9-46, six to seven miles above Sunkesula. The following morning water had risen in level and was turbid and muddy. Spawn nets fixed in the river by 9 a.m. near the Sunkesula fish Farm procured a small quantity of spawn and numerous hatchlings. The hydrological conditions before and after the rains were as follows:—

	Before Rains. (Pre-spawning)	After Rains. (Post-spawning).
Temperature.	28.2 to 28.5°C.	28.5°C.
Colour.	Pale brown	Brown-muddy.
Turbidity	30.0 cms.	2.7 cms.
Free CO ₂	Nil	0.202
CO ₃	0.3	Nil
HCO ₃	17.995	17.385
pH.	8.5	8.1
D.O.—cc/L.	4.746	5.14
Chloride (parts per 100,000)	1.3	1.7
P205-P.	Nil	Present.
NO ₃ -N.	Nil	Present.

Carp and catfish eggs were present. On rearing in the laboratory the carp eggs found to be those of *Cirrhina reba*.

Except for turbidity the hydrological factors do not greatly differ in the pre-and post-spawning periods. The rise in level probable afforded some suitable shallow spawning grounds for the late breeders.

49. On an Interesting Case of Carp Spawning in the River Cauvery at Bhavani in June, 1947.

S. V. GANAPATI, K. H. ALIKUNHI and FRANCESCA THIVY, Madras.

The spawning of the major Indian carps is generally associated with intensive flooding by turbid water. However carp spawn in thousands, was collected from the Cauvery at Bhavani on 29-6-1947 when the water was perfectly clear. There had been neither rain nor flood during the previous week in the locality and in the upper reaches.

The hydro-biological conditions were as follows :

Date.	Place.	Time.	Depth	Colour.	Temp. (°C.)	Flow. (miles per hour.)	pH.	Free CO ₂	D.O. C.C. /L.	Chloride part per 100,000
29/-6/ 1947.	Cauvery at Bhavani.	12 p.m. to 8 A.M.	5 ft.	Bluish-green.	28.2 to 28.8	5.0	8.5	Nil.	4.74	1.7

Spawning commenced by midnight when the temperature was at its lowest and homothermal conditions prevailed. The percentage of saturation of dissolved oxygen was only 83 to 88.

A larger volume of water was being released from the Mettur reservoir for irrigation purposes, and some shallow stretches of the river-bed got submerged, which, it is presumed might have functioned as the spawning grounds.

The spawn collected was reared in the laboratory. It is found to contain 15% *Labeo fimbriatus*, 60% *Cirrhina reba* and 25% *Discognathus* sp.

50. On an Interesting Case of Mortality of Larvicides in the Public Health Fish Nurseries at Ennur, Madras.

S. V. GANAPATI and K. H. ALIKUNHI, Madras.

A set of six nursery ponds - one big and five small ones—is being maintained at Ennur for stocking and rearing larvicides, particularly *Gambusia affinis*. Though lying adjacent to one another, two entirely different sets of conditions are found to prevail in them. While in the large pond the fish thrives and breed quite normally, in the adjoining nurseries, separated from the former only by a narrow earthen bund, all the fish die within a few hours after stocking. Samples of water were analysed from all the ponds and the following data gathered :

	Large Pond.	Small Nursery ponds
Date	30-9-46.	30-9-46.
Time	10.45 A. M.	10.45 A. M.
Colour	Pale Brown	Nil.
Temperature (°C)	33.7	32.3 to 33.1
Turbidity	30.0 cms.	30.0 cms.
Area	150' x 120'	15' x 10'-25' x 15'
Depth	4	2' — 3'
Free CO ₂	Nil.	4.386 ft.— 8.460
CO ₃ (parts per 100,000)	1.65	Nil
HC0 ₃ parts per 100,000)	11.900	Nil
pH.	8.8	6.0
Dissolved O ₂ (CC /L)	6.324	4.319-4.624
Chloride parts per 100,000)	12.0	16.0-26.1
Macro vegetation	<i>Hydrilla</i> , <i>Ceratophyllum</i> .	<i>Hydrilla</i> , <i>lotus</i> , marginal grass.
Fish	<i>Gambusia affinis</i>	Nil

Plankton was nil in the smaller nurseries. Macro-vegetation was luxuriant in the pond as well as in the nurseries.

The excess of free carbon-di-oxide, absence of carbonates and bicarbonates and the consequent low pH (less than 6.0) appear to be the chief factors causing persistent mortality in the nurseries. The influence of natural bottom spring is probably responsible for the accumulation of free carbon-dioxide, covering the bottom with a layer of coral calcite, chalk or broken shells and the introduction of *Chara* have been suggested to neutralise the effect of carbonic acid.

51. On the Bionomics of *Catla Catla* (C. and V.) in South Indian Waters.

P. I. CHACKO and G. K. KURIYAN, Madras.

Through systematic stocking operation since 1922, the Madras Fisheries Department has succeeded to acclimatise and establish *Catla* as a major fishery in inland waters of South India. In its new environment, the food of the fish is found to consist of diatoms (*Coscinodiscus*, *Cosmarium*, *Cyclotella*, *Eraemosphaera*, *Faragillaria*, *Navicula*, *Pinnularia* and *Melosira*)—25%, crustaceans such as copepods and shrimps—25%, algal matter (*Volox*, *Hydrilla* and *Chara*)—30%, Protozoons (*Diffugia* and *Vorticella*)—5%, Polyzoons—1%, sand particles—4% and other unidentifiable items—10%. The fish attains maturity when 22 inches in size, and breeds in the river systems from July to November. The ovarian and fertilised eggs are 1.03 and 4.38 mm in diameter. Period of incubation is 18 hours. The hatchling is about 5 mm in size, and it becomes a fry within 4 days and is characterised by large red tinged operculums. It has attained 29 inches and 9 lbs in the first year, and 3 to 4 feet and 40-50 lbs, in three years. The rate of survival is 90%.

52. Hydrobiological Investigations of the Godavari River with reference to the Indian Shad, *Hilsa ilisha* (Hamilton).

P. I. CHACKO, S. V. GANAPATI and A. R. K. ZOBAIRI, Madras.

The *Hilsa* enters the Godavari upto the Anicuts, about 60 miles from the sea, during July -October for spawning. The methods of fishing employed are destructive. The hydrological conditions are—turbidity : 5.5-30.0 cm., temperature : 26.4-31.8°C, Free CO_2 : 0-0.666, CO_3 : 0-0.9, pH : 7.9-8.3, dissolved oxygen : 1.130-5.606 cc/l, chloride 0.5-205.0, phosphates and nitrates : nil. Current is greatest at the surface, being 1500 cusecs. Plankton in the river consists of *Navicula*, *Stauroneis*, *Aulacodiscus*, *Coscinodiscus*, *Oscillatoria*, copepods, daphnids, crustacean larvae and aquatic insects. Females predominate the *Hilsa* shoals. Sexual maturity is attained when 14 inches by the females, and 11.5 inches by the male. The fish abstain from feeding during the season. The amount of fat in a spawner is half a pound. About 13 lakhs of ova are present in one individual. The ovarian and fertilised eggs are 0.72 mm in diameter. Artificial fertilisation is easily accomplished.

53. Fish Production in Religious Institutional Waters.

P. I. CHACKO, Madras.

Religious institutional waters serve as fish sanctuaries, breeding and distribution grounds, and as fish production centres in Madras. The ecological conditions in these waters are favourable to fish life. The macrovegetation usually occurring in them are *Nymphaea lotus*, *N. rubra*, *N. stellata*, *Nelumbium speciosum*, *Jussiaea repens*, *Ipomea aquatica*, *Ceratophyllum demersum*, *Hydrilla verticillata*, *Vallisneria spiralis*, *Ottelia alismoides*, *Eichornia speciosa*, *Typha elephantina*, *Pistia stratiotes*, *Lemna polyrrhiza* and *Potamogeton pectinatus*. Plankton is represented by *Amphora*, *Anabaena*, *Aphanocapsa*, *Caridina*, *Chaetoceros*, *Closterium*, *Copepods*, *Coscinodiscus*, *Cosmarium*, *Culex* larvae, *Cyclops*, *Daphnids*, *Ephemerid* larvae, *Eudorina*, *Euglena*, fish eggs and larvae, *Gloeocapsa*, *Halosphaera*, *Heliozoa*, *Lyngbia*, *Mastogloia*, *Melosira*, *Micronecta*, *Microcystis*, *Nauplius* larvae, *Oedogonium*, *Oscillatoria*, *Pediastrum*, *Pleurosigma*, *Spirogyra*, *Spirulina*, *Staurastrum*, *Suirerella*, *Synedra*, rotifers and voliger larvae. The growth of fish in the first year is : *Catla* : 27" & 7 lbs, *Gourami* : 10" & 1½ lbs, *Chanos* : 25" & 2 lbs, *Etrophus suratensis* : 9" & ¼ m, and *Barbus heragonolepis* : 7" & ¼ lb. *Catla* has attained 3 feet and 35 lbs in three years in the Madura toppakkulam. A crop of 500 lbs, of fish was harvested in 10 months from the Purnaswalkam temple tank, about 35 cents in area. *Gourami* and *Etrophus* freely breed in these waters, and thus become seed sources. Fish rearing also reduces mosquito larval incidence and thick water blooms. For the latter, *Rasbora daniconius* is best suited.

54. Growth-rate of Twenty-one Species of Fishes of Madras.

P. I. CHACKO, Madras.

The following is the maximum growth in the first year of life of 21 species of fishes reared in departmental and private farms in Madras. *Wallagonia attu*—30", 10 lbs; *Labeo fimbriatus* 15", 2 lbs; *L. calbasu* 14", 1½ lbs; *L. rohita* 26", 6½ lbs; *L. kontius*—9", ¾ lb; *Osteochilus thomassi* 12", ¾ lb; *Cirrhina cirrhosa*—10", 1 lb; *C. reba*—8" ½ lb; *C. fulungee*—6", ¼ lb; *Catla catla*—27", 9 lbs; *Thynnichthys sandkhol*—9", ¼ lb; *Barbus hexagonolepis*—6", ¼ lb; *Megalops cyprinoides*—14", 1½ lbs; *Chanos chanos*—18", 1½ lbs; *Notopterus notopterus*—12", 1 lb; *Lates calcarifer* 18", 3½ lbs; *Ophicephalus marulius*—30", 4 lbs; *O. striatus* 12", 1½ lbs; *Osphronemus gorami*—9", 1¼ lb. *Etrophus sura tensis* 11", ½ lb and *Cyprinus carpio* var *specularis*—16", 3½ lbs. These data enable fish farmers to foretell and control their fish crops.

55. On the Significance of the Accessory Rings on the Scales of *Hilsa ilisha* (Hamilton).

P. I. CHACKO and A. R. K. ZOBATRI, Madras.

Investigations conducted by the authors have revealed that the accessory rings present on the rings of *Hilsa ilisha* indicate the age and growth-rate of the fish. Scales from 170 specimens of both sexes, varying from 10.2 to 20.8 inches in body length, collected from the Godavari delta, were examined. The number of rings was found to represent the body length of the fish in inches, and also the probable age of the fish in months. Thus the specimen of 10.2 inches in body length had 10 accessory rings on its scale; and the specimen 20.8 inches in body length 21 accessory rings. Further investigations are being pursued to ascertain if the fish continues to grow in size and to add to the number of accessory rings until its natural death.

56. On the Productivity of a Fish Pond in Vizagapatam.

P. I. CHACKO, Madras.

The Dykes Pond in Vizagapatam town is used for fish rearing by the department of fisheries. It is 2 acres in area with a maximum depth of 12 and 3 feet respectively. After necessary preparations, it was stocked with 250 fingerlings of *Labeo rohita*, 3083 of *L. fimbriatus* and 1013 of *Catla catla*, from August to October 1945. A fish-crop of 2210 lbs. comprising of 50 *L. rohita* (12-18" & 1½-2½ lbs), 443 *Catla* (10-18" & 1-3 lbs) and 1500 *L. fimbriatus* (10-13" & ¾-1½ lbs) was harvested in March 1946. The receipt and expenditure were Rs 853 and Rs 323 respectively. The pond was again stocked with 5750 fingerlings of *Catla*, 1694 of *Labeo calbasu* and 120 of *Cirrhina reba* in August and September 1946. In March and April 1947, another crop of 2315 lbs comprising of 180 *L. rohita* (12-28" & 1-6 lbs), 1026 *L. calbasu* (10-13" & ¾-1½ lbs), 422 *L. fimbriatus* (11-15" & ¾-1½ lbs) and 3900 *Catla* (10-16" & ¾-2½ lbs) was harvested. The receipt and expenditure were Rs 600 and Rs 88 respectively. The average production of 1130 lbs of fish per acre, per year and the rate of growth of the species are satisfactory.

57. Notes on the Bionomics of the Millions, *Lebistes reticulatus* (Peters) in Madras Waters.

P. I. CHACKO. and R. S. VENKATRAMAN, Madras.

Lebistes reticulatus, considered not to be found in India since the failure of the stock introduced by Major Selby in 1909 to acclimatise in the country, was discovered in the sacred waters of the Rameswaram temple in February 1946. It was then transplanted into waters in the districts of Madras, Tanjore, Malabar, Salem, Cuddappah and Kurnool, where it has since bred and established itself. In the environments of Madras provincial waters, the species is found to be hardy and breeding throughout the year at intervals of three weeks, bringing forth 5-7 young ones, 10 mm in length, at each parturition. The size of the ovarian and fertilized eggs is 1.66 and 2.01 mm. The fish feeds on (*Navicula*, *Cosmarium*, *Synedra*, *Closterium*, *Pinnularia*, *Fragillaria*, *Melosira*, *Nitzschia* and *Surirella*)—30%; insect life, including mosquito larvae—25%; Crustaceans such as copepods, daphnids and cyprids—20%; algal matter such as *Anabaena*, *Cladophora*, *Oscillatoria*, *Pediastrum* and *Spirogyra*—15%; *Rotifers*—5%; Larval worms—3% and miscellaneous stuff—2%. It is a larvicide of moderate utility, its rate of larval consumption being 20-80 per day. It may, however, become in course of time, a useful addition to the indigenous larvivorous species.

58. **Gobioid Fishes of Bombay.**

D. V. BAL and C. B. GUPTA, Bombay.

This paper deals with the taxonomic notes and distribution of a number of Gobioid fishes along the shores of Bombay and its neighbourhood. Of the 38 species recorded here two are new to science and are described in detail. As regards the known species a number of variations in the range of fin formulae, the various proportions of the body and its general colouration were observed and are given as an additional information. The variations noted are strictly in accordance with those observed on comparing the local specimens with the description given by Koumans in this memoir on "Gobioid Fishes of India".

59. **Nucleolar activity in the Oocytes of some Marine Teleostean Fishes.**

H. S. CHAUDHRY, Cuttack.

This paper deals with an interesting phenomenon of nucleolar extrusion in the cytoplasm of the eggs of some marine teleostean fishes. The nucleoli in the young oocytes are fairly big in size and are strongly basophil in nature. They pass out into the cytoplasm through the nuclear membrane as whole bodies. On reaching the cytoplasm they travel towards the egg periphery, where they ultimately disappear without taking any visible part in the process of vitellogenesis. It has been clearly observed that the extruded nucleoli are neither myth nor artifacts due to any mechanical injury.

60. **Modification of the facial structures in the Major Carps of India in relation to their feeding habits.**

H. K. MOOKERJEE and D. N. GANGULY, Calcutta.

In this paper attention is directed to study the correlation between the food, feeding habits and the changes in the facial parts during the developmental period in the four major carps, like *Catla catla*, *Cirrhina mrigala*, *Labeo rohita* and *Labeo calbasu*.

The above four major carps can be grouped into three associations according to their feeding habits :- (1) Fish which feed mainly by sight, (2) Fish which feed by sight aided by taste and (3) Fish which feed mainly by taste. These fish are bathymetrically distributed; some of them feed at the surface of the water, others at the middle and the rests are obtained at the bottom. *Catla catla*, the example of the sight-feeding type, is a surface feeder; *Cirrhina mrigala*, the example of both sight and taste-feeding type is a partly surface feeder and partly bottom feeder; *Labeo rohita*, a member of the taste-feeding type is mid feeder, and *Labeo calbasu*, another member of the taste-feeding type is completely bottom feeder.

From the study of the modifications of the facial structures during the developmental history of the above type it is obvious that the sight feeders possess large eyes, big upturned mouth well adapted for perching, and the absence of sensory papillae and barbels in the above area. Whereas in the taste-feeding types opposite characters are found, and the intermediate form possesses the characteristics of the both in a more or less degree.

It is noticed that during the early parts of the developmental history all the types take in similar diet and all possess similar facial structures and habits. This condition is clearly visible in 10 to 12 mm. stages of all the types of carps. The gradual differentiation of the structures commences from the 14mm. stage and progresses very slowly upto 20-22 mm. stage as during these stages the diet and the mode of feeding practically remain unchanged. The differentiation is very rapid in the stages between 23-50mm. as during this period food and feeding habits also undergo changes in different types. By this time the bathymetric distribution of the feeding range is also established.

The degree of differentiation becomes unchanged or very little changed from 50 mm stages upwards as during this period no further change in the habits or food is marked.

61. **On the probable inter-relationship between the Major Carps of India.**

H. K. MOOKERJEE and D. N. GANGULY, Calcutta.

All the four types of the major carps of India, viz, *Catla catla*, *Cirrhina mrigala*, *Labeo rohita* and *Labeo calbasu* are identically same and possess similar feeding habits and bathymetric distribution during the early stages of their development. The sequence of development in all of them is also very similar.

The presence of the obvious correlation between the nature of food, feeding habits and the modifications of the mouth parts speculate that the variable distribution is the cause of the evolution of the modern Major Carps from *Catla catla* like ancestor, where barbels and sensory papillae were absent like the modern *Catla catla*, due to the fact that during early stages of the life history all of the fish show *C. catla* like form.

The fact that the barbels and sensory papillae are relatively late in developing in *Cirrhina* and *Labeo* and the absence of them in *Catla* argues in favour of their being recently developed characters. Would it not be the case, vestigial of these structures should have persist in *Catla catla* as it is well known how tenaciously vestigial structures persist, even when they do not subserve any conceivable function, so long as their retention is harmless to the organism. In the case of the barbels and sensory papillae, their presence would not involve any serious tax on nutrition during the life time of the fish nor be detrimental in any other way, and under such circumstances, once they had been evolved for any special purpose, the tendency of heredity might be sufficient to secure their retention even though their primitive physiological value had become lost.

From the sequence of development, following the recapitulation theory, we can justify that the extremely modified form like *Labeo calbasu* had developed from the less specialized form like *Catla catla* through the intermediate forms like *Cirrhina mrigala* and *Labeo rohita*.

62. Pyloric Caeca in *Mugil troschelii* Bl.

M. RAHIMULLAH, Hyderabad-Deccan.

The morphological details of the alimentary tract in general and the structure and disposition of the pyloric caeca in particular have been described. The caeca in this fish are numerous and are found clustered over the 'Crop' in the form of bunches, each bunch consists of three to four diverticula opening into a duct, these ducts in turn open into the pylorus.

The caeca of this fish have been discussed in relation to those of other members of the fam. Mugilidae, and it has been inferred that the disposition and the number of the caeca have practically no taxonomic importance in the systematic study of fishes even in a single family.

63. The structure, form and development of scales in *Mugil* sp.

S. MOOKERJEE, Calcutta.

This paper embodies details of the structure, form and development of scales of *M. sp.* A morphological survey reveals the characteristic feature of the scales. The location of focus, the nature of circuli and disposition of radii have been studied in these scales. The posterior fields of the scales are delineated with small elevations, placed one after another in a linear way.

Developmentally it has been found that these scales are like cycloid scales at their earliest phase, later they assume the adult condition through successive phases or development.

The affinities of these scales with cycloid and ctenoid scales described previously have been indicated.

64. On the Development of the Vertebral Column in Crocodilia.

H. K. MOOKERJEE, and R. N. BHATTACHARYA, Calcutta.

The notochord of Crocodilia has two sheaths instead of one. Centrum is formed by two concentric rings of *perichordal tube* instead of one and not by addition to or prolongation of the base of the upper (or in some cases by addition to the lower) arch as stated by previous investigators. The upper arch rests at the dorsal corners of the concentric rings of the *perichordal tube* and there is a suture in between, giving their distinct identity. The dorsal arch is formed not only by the *basidorsals* of either side but, there is a third piece of cartilage as *supra-dorsal* from which the neural spine is formed. Apart from cartilaginous *basidorsals* there are membranous anterior and posterior *connective tissue arches* which are also transformed to a cartilaginous condition at a much later stage. These three elements are responsible for the formation of the *upper arch* which escaped the notice of previous workers in this line of enquiry. The *basiventral* element represents a flat piece of cartilage for the atlas vertebra. The rest

of the body-vertebrae have united *basiventralia* as *intercentra*. Caudal vertebrae have regular haemal arches with a third piece as *infraventralis*, the existence of which was not known.

Two types of ribs are present, one is the ventral rib articulating with the united *basiventralia* of atlas vertebra with one head (ventral), the rest are all of the dorsal type; a few have two heads and others have only the trabecular process articulating with diapophysis.

65. Observation on the Bursa of Fabricii in Domestic Fowl.

J. N. RUDRA and S. MOOKERJEE, Calcutta.

Bursa of Fabricii of birds has a much debatable existence in the adults. Various workers have formed different opinion about the fate and function of this structure. In order to elucidate the fate and function of Bursa Fabricii, a large number of adult fowls were examined by us. Morphological and histological studies revealed the well developed condition of this structure and the presence of copious sperms inside the Bursa led us to assign the function of a spermatheca to this structure.

Detailed anatomical and physiological works are being carried on.

66. Reproduction and Early Pregnancy in the Vespertilionid Bat—*Scotophilus wroughtoni* (Thomas).

A. GOPALAKRISHNA, Nagpur.

A general survey of the work done on the reproduction of Micro-chiroptera indicates that the sex rhythm of the bats of the cold climates is very different from the same in the bats of the tropical regions. In the European varieties usually copulation occurs during late autumn and the Spermatozoa are stored inside the genital tract of the female through winter and fertilization occurs in spring. These spermatozoa therefore, hibernate for nearly 5 months. (Harrison Matthews 1939). Several authors working on American bats have recorded that copulation occurs in spring, and is immediately followed by pregnancy. (Mary, J. Guthrie 1933). The only work on tropical bats (Baker and Bird 1937) shows that in New-Hebrides copulation occurs in spring only. Harrison Matthews has also recently shown (1942) that in most of the African bats, presumably there is nothing comparable to the winter hibernation of spermatozoa as occurs in European species.

The present study also proves that copulation occurs at the beginning of spring and is followed by fertilization and pregnancy in *Scotophilus wroughtoni*. The males and the females come to sexual activity at the same time of the year, that is spring. There is an annual breeding season. The males and the females become fecund in their first year, that is before they are one year old a phenomenon which has not been recorded in any species of micro-chiroptera so far.

of searly stag pregnancy :—

The earliest stage obtained was morula. A slightly later stage with clefts between cells is also observed. The third stage was an un-implanted free blastocyst which has differentiated into an outer trophoblast and an inner cell mass which is attached to the trophoblast at one pole. Further stages are being studied.

67. Plant Protection Service.

K. B. LAL, Cawnpore.

Plant Protection Services, whether organised by the Central Government or in the provinces and states, being new ventures in India, raise certain important issues of principle, organisation and operation which call for discussion. The main functions of a Plant Protection Service must be to organise large-scale control measures against pest and plant diseases, to prevent their entry or spread in the provinces and states, to predict and issue warnings against them and to educate the farmer in the methods and need for their remedies against them.

Though governments must always provide technical advice and assistance in fighting pests and diseases, in the initial stages of the Service the entire cost of all operations also must be borne by them. This latter concession is necessary because the cultivator is not yet in a position to realise the benefits that may accrue to him from the adoption

of measures against pests diseases. After the stage of intensive persuasion and propaganda has passed, some legislative measures may be necessary to compel such cultivators as do not adopt control measures against pests and diseases or allow others to do so, thereby injuring not only their own interests but also those of their neighbours. Legislation should also be necessary to regulate the sale and manufacture of insecticides and fungicides. The issue of forecasts of pest and disease outbreaks organisations of quarantines against pests and diseases and propaganda must always be the responsibility of governments. The Central Government should undertake the training of staff needed for Plant Protection Services, arranging the courses of training in such a way as to allow ample scope for specialisation in different branches of plant protection work. Plant Protection Services must continually collect facts and data for assessing the efficacy of the measures adopted by them. The Service must be under a unified control and be alive to need for collaboration with research workers on the one hand and with district agricultural staffs and indeed all those interested in village improvement, on the other.

SECTION OF BOTANY

PRESIDENT : K. AHMAD CHOWDHURY, M.B.E., D.Sc., F.N.I.

Cryptogams

1. A revision of the genus *Turbinaria* Lamx.

FRANCESCA THIVY, Madras.

Miss E. S. Barton's famous monograph of the genus was written in 1891 and since then important collections from all regions have accumulated and have necessitated a revision.

Barton recognized 9 species and 2 varieties. While the former are maintained, the latter are here raised to species and several new species are reported. Additional specific criteria have been established. The geographic distribution of the species is considered here to be discontinuous.

A synoptical key to the species, illustrated specific descriptions, references to literature and citations of herbarium specimens are provided.

2. *Asterionella Krusadiana* Sp. Nov. from the Gulf of Manar.

FRANCESCA THIVY, Madras.

The specimens were found free-floating in a sample of water from the channel between Krusadi I. and Pamban I. on the 28th February, 1947, along with *Enhalus* leaves with epiphytic *Spirorbis* shells.

Resemblance to *A. kariana* Grun., Cleve & Grun. in forming spiral colonies and to some extent in the shape of the frustules, to *A. notata* Grun. in the frustules in a chain diverging in all directions., and to both these species in the presence of a number of chromoplasts scattered throughout the frustule, is found in the specimens under discussion, but the broadly cuneate shape of their frustules, marks them as being distinct from either of the above species. The broader ends of the frustules are joined to form the chain and the tapering takes place towards the free, faintly rounded, narrower ends. A detailed illustrated account of the new species is given.

3. Algae of the ponds at the Govt. Fish Farm, Madras.

FRANCESCA THIVY, Madras.

A systematic study of the algal blooms and littoral algae of the fish ponds was carried out during the year, August 1946-47. Over eighty genera are represented.

The phytoplankton is on the whole of the "Baltic" type as it shows predominance of Chlorococcales and Myxophyceae and paucity of desmids. In some ponds Euglenophyceae are often dominant, which is a pond as against a lake feature. The composition of the phytoplankton in the different ponds, which are under similar conditions, also contrasts with lakes in its diversity.

Illustrated descriptions of the species and ecological findings are given.

4. Some New Hosts of *Cephaleuros*.

K. M. SAFEEULLA and H. C. GOVINDU, Bangalore.

In the present investigation the authors have recorded a number of hosts of the alga *Cephaleuros*. The infection of this is very intense during the rainy season.

On *Psidium guajava* L. and *Olea dioica* Roxb., the alga is definitely parasitic in nature. In these cases a greater portion of the thallus of the alga is intramatrical, as a result of which, the cells of the leaf tissue of the host assume a polygonal aspect. Out of the twenty seven hosts collected, except the above two hosts, the rest show that the alga is essentially epiphytic. In a few cases, the alga, even as an epiphyte, causes damage to the host, by reducing the photosynthetic area by forming innumerable dense orange coloured patches.

5. Indian Sphagnums.

ARUN KUMAR SARMA, Calcutta.

Very little work has been done on Sphagnum mosses of India. A complete list together with a key, descriptions and their distributions have been drawn up with special reference to the little known species. It has been found that out of 16 species occurring in India, 5 are endemic. The distribution of Indian Sphagnums in relation to their world distribution is discussed in the paper. The various economic uses of the genus with special reference to their absorbent property and as such their uses as a good substitute for bandaging in surgical operations have also been dealt with.

6. Sargassums of Indian Seas.

KALIPADA BISWAS and ARUN KUMAR SARMA, Calcutta.

Collection of this seaweed dates from as early a period as 1820. The total number of species recorded from Indian seas is 33. These are distributed along the coast lines of India and around the islands of the Indian Ocean, particularly the Andamans, the Nicobars and the island of Ceylon. There are 3 endemic species in India. A thorough description and a key to the different species of Indian Sargassums have been given in the paper. The range of distribution of these species has been delineated in the map. It has been observed that the Indian species show a greater affinity with the Pacific and Malayan ones. About 45% of the Indian species occur in the Pacific, 33% in the Malayan region and 6% in the East African coasts. The distribution of the Indian species of Sargassums against the background of their world distribution has been discussed in the paper.

7. Distribution of Indian Lichens.

KALIPADA BISWAS and DHARANI DHAR AWASTHI, Calcutta.

The total number of authentic species of lichens so far recorded from India is about 700, under 115 genera and 38 families. If the varieties and form are included, the number comes to 800. The records made are chiefly from the eastern and the western Himalayas, Bengal, Assam, Madras, Nilgiris, Ceylon and the Andamans. The picture of the distribution of Indian lichens though cannot at this stage be complete with many parts of India still lying unexplored, yet the preponderance of some families in a particular climatic zone can be clearly demarcated.

The temperate rain forest region of the east Himalayas are rich in foliose and fruticose lichens belonging chiefly to *Collema* and *Stictis*, *Peltigera*, *Cladonia*, *Permitia*, *Usnea* and *Physcia*, while the subtropical and tropical belts of India, Ceylon and the Andamans are dominated by *Graphis*, *Pyrenopeziza*, *Thelotrema* and others. Total number of endemic species is 316 confined to botanical regions of India and four small genera only are considered endemic.

Various ecological factors particularly the climatic factor mainly control the distribution of lichens in India. The tropical lichens, majority of which are crustaceous and squamulose bear close affinity to the allied species of the East Indies, Australia, New Zealand, Tropical America and Africa. The lichens of the temperate region show closer affinity to those of China, Japan, Europe and Temperate America.

8. The Cryptogamic collection of the Royal Botanic Garden, Calcutta.

KALIPADA BISWAS and DHARANI DHAR AWASTHI, Calcutta.

The Cryptogamic collection in the herbarium of Royal Botanic Garden, Sibpur, dates for a period of about a century and half. The collection is composed of good number of specimens of Algae, Fungi, Lichens, Mosses and Ferns representing different parts of the world. The liverworts are very few in number. The ferns representing the collections of India and adjacent countries are too large for consideration in the present paper.

The approximate number of specimens in each of these classes of plants is Algae -3800, Fungi-2400, Lichens-3100 and Mosses-9000. Of these many are undescribed, unrecorded and some are even new to science. These are all being arranged in classified order with a view to treating each of these classes in detail separately.

It is hoped that the information given in the paper will be helpful to those working in these branches of Botany. Type specimens of the different groups may kindly be sent as a gift or in exchange for their proper preservation to the Herbarium, Royal Botanic Garden, Calcutta,—the National Herbarium of India,—where Cryptogams along with the Phanerogams are receiving due attention.

9. On *Aspiromitus mamillispora* Bhardwaj Sp. nov., from Kandy, Ceylon.

D. C. BHARDWAJ, Lucknow.

In this note the author describes a new species of *Aspiromitus* St. (*Sp. Hep.* V, p 957, 1912-17), from Kandy, Ceylon. The specimen was collected by Dr. S.K. Pande in December, 1939.

Dioecious, thalli small, more or less fan shaped, thin and soft, bearing mature sporogonia 20-30 mm long. Involucre 2-2.5 mm solitary; Spores dark brown, warty-mamillate about 40 microns. Elaters brown, long, multiseptate, slender and unbranched. No male plants were seen.

10. A Preliminary Report on the Mushrooms of Baroda.

S. T. MOSES, Baroda.

The practice in cutch, where annually the Maharao receives the first mushroom crop - Use of mushrooms in Gauri Puja - Hints to distinguish between edible mushrooms and others - Puffballs, 'Horn of Plenty' and 'Chattri' are other edible Fungi- Spores of mushrooms the chief clue to identification and their colour variations- Difficulties in collection and preservation - The food value of mushrooms and the imperative need for distinguishing the edible ones from the poisonous ones -Mushrooms to be used mixed with other vegetables, prawns, fish etc - Six selected recipes for curry, pickling, stew, savoury etc -Mushroom cultivation and fishculture- A tentative check list of mushrooms in the State—*Psalliota*, (*Agaricus*), *Marasmius*, *Lepiota*, *Amanita*, *Coprinus*, *Hygrophorus*, *Volvaria*, *Pluteus*, *Hypholoma*, *Russula*, *Armillaria*, *Pleurotus* and *Psethyrella*.

11. On *Camptylonema indicum* Schmidle and *Camptylonemopsis* gen.nov.

T. V. DESIKACHARY, Madras.

The genus *Camptylonema* was established by Schmidle on an alga collected from Bombay, which he called *Camptylonema indicum*. This genus was placed by him under the Stigonemataceae. Ghose and, following him, Geitler doubting the occurrence of true branches in the alga, transferred the genus to the Seytonemataceae.

An alga agreeing in all respects with *Camptylonema indicum* Schmidle was recently recorded by the writer from Cochin. This alga is considered by the writer the same as Schmidle's *C.indicum*. It possesses true branches in addition to false-branches. The genus is therefore retransferred to the Stigonemataceae.

Following Geitler's suggestion, a new genus, *Camptylonemopsis*, is created tentatively to include all those forms possessing crescent shaped filaments, but not showing true branches. This new genus is placed under the Microchaetaceae.

Three new species and two new combinations have been included under this new genus, *Camptylonemopsis*, viz., *C. pulneyensis* sp.nov., *C.minor* sp.nov., *C. Iyengarii* sp.nov., *C. lahorensis* (Ghose) comb.nov., and *C. Danilovii* (Hollerbach) comb.nov.

Phanerogams, Taxonomy and Ecology

12. Indo-Burmese species of *Grewia* Linn.

V. NARAYANASWAMI and R. SESHAGIRI RAO, Calcutta.

Much confusion exists in the synonymy of species of the genus, *Grewia* Linn. Specific limits of a large number of the Indo-Burmese species of the genus require re-orientation in spite of the critical work on the genus done during the past three decades. A complete revision of the genus has therefore become necessary.

The genus is mainly confined to the Tropical and Subtropical zones, Africa, claiming about 100 species and India and Burma, nearly 45 species. With the data collected we conclude that Africa has been perhaps the original home of *Grewia* Linn. from where, the lines of distribution might have proceeded first towards Peninsular India. From there, two diverging lines of distribution one to the North-east and the other to the South-east appear to have arisen.

As a result of our critical diagnosis of the genus, we agree with Burret in raising the two sections of the genus *Grewia* Linn, namely, *Omphacarpus* and *Microcos* to generic rank, namely, *Microcos* Linn. Confusions in groups, *Tiliaefolia* and *Hirsuta* have been elucidated. Our critical study of the three closely allied species, namely, *Grewia asiatica* Auct. (non.Linn), *G. subinaequalis* D.C. and *G. Hainesiana* Hole shows that they are all only Eco-forms of the common Indian wild species namely, *G. subinaequalis* DC. *G. asiatica* Linn. originally described from a garden plant at Surat (India), does not seem to occur now in India. Nomenclatural revision of some of the species of *Flora of British India* has been carried out.

13. Revision of Indian *Trapa*.

KALIPADA BISWAS and JYOTIRMAY MITRA, Calcutta.

The systematic position of the Indian *Trapa* received not much attention of the Indian botanists so far. There are 5 species recorded from different parts of India. Of these *Trapa bispinosa* Roxb. and *Trapa natans* Linn. are the most widely distributed species. *T. bispinosa* Roxb. is mostly confined to the plains whereas *T. natans* Linn. generally grows in the lakes, pools and puddles in the hilly region upto the elevation of 4,000 ft. in the foot of the Eastern Himalayas.

The distribution of the genus *Trapa* is rather limited being mainly confined to the old hemisphere as shown in the map.

Detailed examination of the Sibpur Herbarium specimens and other parts of the world, however, leads to modification of some of the conclusions hitherto arrived at on Indian species of the genus *Trapa*. Detailed investigation of the two species namely *Trapa bispinosa* Roxb. and *T. Maximowicksii* Kors has been undertaken together with a view to studying their internal morphological and cytological characters. Records of field observations on the genus in Bengal, the borders of Assam and Burma, Loktak lake, Manipur and South Burma, reveal interesting facts on the nature and growth of the species in different habitats.

Medicinal and economic importance of the species and possibilities of using the fruits as a substitute for food grains during scarcity have been discussed in the paper.

14. Observations on *Ipomoea biloba* growing in Benares.

N. K. TIWARY, Benares.

The author in this paper reports the thriving growth of the plant grown from seeds collected at Puri in 1935. But at Benares the plant flowers only during the winter season i.e. Nov-Dec. Furthermore, no seed formation has been observed. Lastly, a few seeds from the lot obtained in 1935 were found to be viable after an interval of twelve years since they were collected.

15. On some features of Taxonomic interest in the Gamopetalae of Nagpur.

R. L. NIRULA, Nagpur.

During the last three years, the local Gamopetalous flora has been studied with the object of identifying all plants including the weeds, cultivated plants and forest shrubs and trees. During the course of this work, several features of interest were observed and the present communication is just to indicate only a few of them. (1) *Celsia coromandeliana*. At a spot in the old Nagnadi, behind the Maharaj Bagh Gardens, three types of plants were seen—the Normal plants, the Giant plants and the Dwarf-plants. The Giant plants differed from the Normal ones in their greater height and larger leaves, while the Dwarf plants differed in their larger number of radical leaves and their larger size. In both, Giant and Dwarf plants, the inflorescence was never so long as in the normal plants. (2) *Justicia quinqueangularis*, var. *peplodes*. The local specimens of this variety showed several characters suggesting that it serves as an intermediate form between the typical *J. quinqueangularis* and the typical *J. peplodes* and that it should be retained as a variety and not raised to the status of a species as it has been done in some flora. (3) *Rungia repens* & (4) *Rungia elegans*. The study of both of these species (3) and (4) showed that these two should be combined into one species. Hooker had suggested that *Rungia elegans* is possibly the larger form of *R. repens* but all along, these have been treated as two distinct species in the different floras. These show very close resemblances and also some differences to suggest that they should be recorded as two varieties of the same species. One plant of *Rungia elegans* proved to be of extraordinary interest in this connection since on one side, it had the decumbent tufted habit of *R. repens*, while on the other side which was the major part of the plant, it was erect with the branches quite away from each other like the typical *R. elegans*. Several more plants have proved to be of similar interest.

Morphology and Anatomy.

16. Confusion in systematic position in some of the Indian species of Rhododendrons.

KALIPADA BISWAS and R. SESHAGIRI RAO, Calcutta.

Rhododendrons received attention of the botanists from a very long period for the magnificent colour and texture of the flowers which are really the glory of the Himalayas. There are nearly 1250 species recorded from the different parts of the world. Of these India claims about 86 species, and of these again, nearly 84 species are in the Eastern Himalayas, 5 of which extending up to the North-western Himalayas, and Ceylon and Nilgiris have only one species each.

Fie'd investigations reveal that there exists considerable confusion in the systematic position of the common species such as *R.campanulatum* D.Don, *R.Camelliaeflorum*, Hook.f., *R.cinnabarinum* Hook. f., and *R.Roylei* Hook.f.

The chief reason for such a confusion is the wide range of variations in the size of the plant, leaves and other morphological structures, number of flowers in each bunch, colour and texture of the flowers in the species, mainly due to their adaptation and acclimatization, different habit conditions and other ecological factors to which this genus is highly sensitive. Light, rainfall, snow-fall, temperature in higher altitudes, shade, particular hill slopes having favourable edaphic conditions, association with a particular plant community, such as *Viburnum* association, *Juniperus* association, *Abies Webbiana* association and others have definite effects on the large range of morphological variations in this genus particularly those growing in the Sikkim Himalayas. Detailed study clearly shows that there is sufficient scope yet to modify Hooker's descriptions and observations as recorded in some of his monumental publications.

An outline of the study of the genus from the systematic and ecological point of view is dealt with in the paper.

17. A survey of the Elephanta island flora.

MUHAMMAD S. KHAN, Kurla.

During 1943-44, Professor F. R. Bharucha of the Royal Institute of Science, Bombay and myself carried out a cursory survey of the floristic elements of the island. But since then it was thought to make a fuller survey and present a prospective view of the plant envelop to the visitors of the island who come in thousands to visit the caves for which the island is famous at present.

The paper gives a systematic list of the indigenous flowering plants of the island and describes the peculiar nature of the flora.

18. Leaf development at the growing apex and phyllotaxis in *Heracleum*.

GIRIJA PRASANNA MAJUMDAR, Calcutta.

The origin of leaf at the growing apex and phyllotaxis in development have been studied in *Heracleum*. The leaf originates in two stages, namely, (1) the Initiation, and (2) the Emergence.

The initiation takes place by the localized activity of the flank meristem on one side of the apex resulting in the formation of the *soubassement* (Gregoire), or the foliar foundation, i.e. the axial component of the primordium.

The emergence take place only after the desmogen strand, the future median trace of the emergence (the primordium), has differentiated up to the base of the foliar foundation. Intense activity starts in the corpus derivatives of the foliar foundation just ahead of the desmogen strand resulting in the organization of a core of meristematic tissue capped by 3 layers of tunica. Soon the smooth surface of the foliar foundation is "heaped up" and the foliar emergence has taken place followed closely by the desmogen strand as its median trace in the process of differentiation.

A leaf is thus composed of two parts : the axial component and the free limb, and these together make up the *phyton*, or the growth unit.

Heracleum has a 2/5th. phyllotaxis with a clockwise arrangement of the leaves. The angular divergence is 144° . Developmental studies show that this is true only on adult shoots. At the growing point the angular divergence is seen to vary between 144° and 160° , the widest divergence being noticed between the youngest primordia near the tip. The reason of these variations have been discussed.

Determination of the cause or causes responsible for the orderly appearance of primordia at the shoot apex, has been so far a speculation. Developmental studies offer a solution. Place of a primordium is primarily determined by the basifugally differentiating desmogen strand which, separating from a lateral strand of a primordium down the axis, follows a definite course upwards and enter the new primordium as its median trace. Its origin and development precedes that of the primordium. The 'widest gap' is really provided by the formation of the foliar foundation.

Non-correspondence of the position of the abaxial fold or ridge with that of the median strand, and the unequal growth of the two sides of a primordium in the early stages of development, have been discussed.

Other points of interest in this connection, such as, number of primordia in contact with the axis at a time at the growing point, clockwise or anticlockwise, disposition of the genetic spiral have also been discussed in this paper.

19. The interpetiolar stipules of Rubiaceae with special reference to *Paederia foetida* Linn and *Ixora parviflora* Vahl.

GOPAL CHANDRA MITRA, Calcutta.

The developmental studies of the interpetiolar stipules of *Paederia foetida* Linn and *Ixora parviflora* Vahl show that the stipules in both the species are formed by the divergences of the product of the fused adjacent lateral extensions of the pair of opposite primordia from their bases. The fused portions of the stipule do not undergo any independent growth prior to their fusions. The formation and development of the stipule do not take place either by intercalary growth or by suppression of growth at the apices of the primordia.

In both the species the development, growth and divergences of the stipules from the bases of the primordia are influenced by the branches of the lateral traces of both

the opposite primordia which also form their vascular systems. And it is the course, orientation and formation of the vascular system of the stipules that determine their forms and shapes. The formation, courses and orientation of the vascular systems of the stipules differ in the two species. No swelling of the bases of the primordia opposite the branches of the lateral traces is observed. The tissue of the stipules and the foliar primordia do not show similar features of growth and differentiation.

The stipules of both the species are composite structures both in respect of their tissues and vascular supply but they differ in developmental details.

20. Endosperm Development in *Lobelia Pyramidalis* Wall.

K. SUBRAMANYAM, Bangalore.

The development of the endosperm in *Lobelia pyramidalis* Wall. is *ab initio* cellular. The primary endosperm nucleus divides earlier than the egg. It divides just above the centre of the embryo-sac and a transverse wall is laid down thus forming an upper primary micropylar chamber and a long primary chalazal chamber. Next a vertical wall is first laid down in the micropylar chamber and this is soon followed by a similar type of wall in the primary chalazal chamber. Thus a 4-celled endosperm is formed. Sometimes the divisions in the two primary chambers are simultaneous. Subsequently, these pairs of cells become divided transversely, first the lower pair and then the upper; the result is an 8-celled endosperm is formed. Of these, two cells of the first tier develop into the micropylar haustorium, and the last pair of cells into the chalazal haustorium. The remaining two middle tiers form the endosperm tissue. The development of the endosperm thus follows the *Scutellaria*-type of Schnarf. The micropylar haustorium, which is made up of two uninucleate cells, persists for a long time in the mature seed and is more aggressive than the chalazal haustorium, which is also 2-celled.

21. The Development of the Female Gametophyte in *Lilium neilgherrense* Wight.

H. C. GOVINDU, Bangalore.

The hypodermal archesporial cell directly functions as the megaspore mother cell. The nucleus of the megaspore mother cell pass through the heterotypic division, forming two daughter nuclei and these in turn undergo the homotypic divisions, thus forming a primary four-nucleate embryo-sac. No walls are formed around these nuclei. These four nuclei arrange in such a fashion that only one remains at the micropylar end, while the other three migrate to the chalazal end of the sac, thus showing the 1+3 arrangement. All the four nuclei divide simultaneously. The spindles of the three chalazal nuclei unite and a single bipolar spindle is formed. Thus as a result of this third division a secondary four-nucleate embryo-sac is formed with two haploid nuclei at the micropylar end and two triploid nuclei at the chalazal end. Now, three of these four nuclei, the two micropylar and the upper chalazal pass through the typical division; the fourth or the lower chalazal nucleus divides in an abortive manner. The mature embryo-sac shows a normal egg-apparatus, an upper polar nucleus, a lower larger polar nucleus and three antipodal cells; of these the two basal ones are smaller than the upper. Thus, the development of the female gametophyte in *Lilium neilgherrense* Wight conforms to the *Fritillaria*-type.

22. Prothalli of *Gymnogramme calomelanos* Kaulf.

T. S. MAHABALE and J. J. SHAH, Bombay.

The paper gives an account of the prothalli of this fern growing wild in the suburbs of Bombay. The prothalli are 0.2 - 0.5 cm in diameter and are green in colour. Their shape is extremely variable ranging from typical cordate or spatulate to something like cauliflower. In most cases they have 3-5 lobes around a central shaft arising from the spores. A few gemmae are also found in the midst of the lobes. The reproductive organs are also variously distributed. In small strap-shaped prothalli only antheridia are found whereas in the large prothalli either archegonia or both the archegonia and antheridia are found. The gemmae in some prothalli were replaced by apogamous buds developed near the notch. The cushion as a rule is either not distinct or is wanting.

The genus *Gymnogramme* is well known for its irregular prothalli and the present species adds one more instance to the two cases already known in the genus.

Study of the sporogenesis and anatomy is in progress.

23. Several-layered Tapetum in *Daemia extensa*, Br.

R. L. NIRULA and P. D. GADKARI, Nagpur.

The family Asclepiadaceae has been studied embryologically by Stevens, Frye, Gager, Finn, Sabet and Pardi and a number of embryological peculiarities have been reported. Work on the local plants in Nagpur was undertaken to determine whether the features known so far characterise the family as a whole. In various respects, the study proved fruitful. In *Daemia extensa* there were observed two microsporangia in an anther, linear tetrads of microspores and a several layered tapetum surrounding the resting microspore mother cells. This became reduced to a two-layered jacket at the leptotene stage of the first reduction division and when the meiosis was complete, it was only one layered with much smaller cells. At the beginning of the pollinium development the tapetal cells increased in their size but finally they got disintegrated slowly and slowly. Throughout the whole process of spore development and pollinium formation, the tapetal cells remained uninucleate, a few binucleate cases having been observed only in the early stages of pollinium development.

24. Some new techniques in the study of the male gametophyte of the Angiosperms.

N. K. TIWARY, Benares.

The author gives an account of (1) a modified Carnoy's fluid in which instead of chloroform, sulphuric ether is used. This makes incorporation of celloidin, in the fluid, possible. This modified fluid can be used both for fixing the material as well as for making the material stick to the slides, thus facilitating subsequent manipulations without any risk of losing the material. (2) making up 1N HCl in 9% alcohol instead of in water. This fluid is used as a fixing & a hydrolysing reagent & helps to avoid several difficulties of the customary technique employed in Feulgen reaction.

Physiology.

25. Hunger signs on Mango.

P. K. SEN, P. K. ROY, and B. N. DE, Sabour, Bihar.

Nitrogen, phosphorus and potassium deficiency symptoms on mango, variety *Langra*, developed as a result of moderate and acute deficiencies of these elements in the nutrient solutions employed in a sand culture experiment have been described with coloured plates. The inter relation of these elements in mango nutrition has also been discussed. Plants showing the starvation effects could be brought back to normal health by replenishing the missing elements. The hunger signs thus determined would help to serve as a key in dealing with mineral deficiencies in soils of mango orchards.

26. Chemical studies in the physiology of mangoes.

S. C. AGARWALA, Lucknow.

I—Standardization of the conditions for the dry weight determination.

The paper deals with experiments made to standardize the conditions for the determination of dry weight of mango fruits, at various stages of development and ripening. It has been concluded that results accurate to within 2% of the correct value can be obtained by drying the mango pulp at 60° for 24 hours in the case of mangoes during the period of growth and for 72 hours in the case of mangoes during the period of ripening.

IV—Tannin in relation to necrosis of mango.

The paper deals with the changes in tannins during growth and ripening of *Dasehri*, and *Safeda* fruits both from healthy and diseased orchards and due to necrosis in *Dasehri* *Safeda* and *Fazli* varieties. The trend of the changes was found to be the same in the fruits from both the orchards. The significance of differences in the analytical results of necrotic and corresponding healthy fruits from diseased and healthy orchards have been tested statistically. The concentration was found to be significantly more

at the tip than in the other portions in the healthy as well as the diseased fruits of various stages. The concentrations in the diseased regions of the II, III and IV stages of necrosis were found to be significantly more than in the corresponding regions of the healthy fruits from the healthy as well as the diseased orchards in most cases. The tannins present in the mango fruits seem to belong to the pyrogallol and phlobatannin groups.

The changes in the concentration of tannins in growth and ripening of the mango fruits, the distribution of tannins in the different parts of the fruits and the known toxic effect of tannins on fungi, strongly indicate that tannins are responsible for keeping the fungi which have entered the green fruits latent till such time as ripening starts and for the differential tissue resistance of mangoes to the pathogenic fungi.

27. Penetration of mercuric chloride in some fruits (healthy and diseased) and its fungicidal action.

G. S. VERMA, Lucknow.

The paper deals with some experiments on rate of the penetration of mercuric chloride in peeled and unpeeled fruits, both in healthy and rotting condition.

Fungicidal action of mercuric chloride on some common rot-producing fungi, e.g., *Fusarium* sp, *Rhizopus* sp, *Acrothecium* sp, *Aspergillus* sp, *Alternaria* sp etc. has also been studied on the host tissue and artificial culture.

28. On the formation of lesion by gases on mango fruits.

G. S. VERMA, Lucknow.

This paper deals with the effect of sulphur dioxide, ethylene and mixture of sulphur dioxide and ethylene on mango fruits with particular reference to the formation of lesions.

These gases were administered both to plucked fruits of some important varieties in the laboratory as well as in healthy orchards to fruits while still on the trees. The method of treatment of the fruits with gases was carried out either by giving a continuous current of desired concentration or by enclosing the fruits in containers with a fixed dose for definite periods. Experiments variously devised, have been described.

Sulphur dioxide gas produces brick-red coloured lesions round the lenticels on the general surface of the fruit. Heavy doses produce large dark brown patches through the coalescence of these lesions. At low concentrations, the number and size of lesions per unit area are roughly proportional to the amount of sulphur dioxide gas administered and to the period of exposure of the gas. It has, however, been found that below a certain minimum concentration of the gas no lesions are produced even though the period of exposure be very much prolonged.

A certain degree of difference in varietal susceptibility to gas effects has been found in the different varieties.

With very low concentrations (40 : 100,000) under laboratory treatment, the fruits showed shrinkage of tissues at the tip accompanied by change of skin colour. The shrinking of tissues was uniformly spread with slightly heavier doses.

This condition of the affected fruits in no way resembles the 'Black-tip' disease of the mango fruit.

In the very young condition, the lesions develop with 16 : 152,000 concentration which soon coalesce giving the entire fruit dark colouration causing ultimate dropping off.

Ethylene in low doses (1 : 10,000) induces ripening while slightly heavier concentrations (10 : 10,000) produce brown coloured lesions around lenticels all over the skin of the fruit. The spots or lesions increased in size as heavier doses were given. These spots coalesced forming dark brown patches on the skin of the fruit. A concentration of 3 : 100,000 and 5 : 100,000 produced no effect whatsoever when administered even for very prolonged periods.

The effect of sulphur dioxide and ethylene in admixture on the fruits was evidenced by the formation of dark brown lesions. The treatment with low concentrations under laboratory conditions induced ripening, and usual lesions appeared.

92. Preliminary studies on the effect of mineral nutrition on the growth and development of Jute plants.

J. C. SEN GUPTA, Calcutta.

Two species of Jute—*Corchorus Capsularis* (D154) and *C. Olitorius* (Chinsura green) were grown in sand cultures in glazed stoneware pots. There were 5 pots for each treatment and four plants in each pot i.e., 20 plants per treatment.

The preliminary experiment reported here include :—

- (1) Effect of three standard solutions : Hoagland, Knop and Richards with micro-nutrients. Sown on 23.4.45.
- (2) Effect of sowing time on the relative influences of the three standard solutions. Sown on 23.5.45
- (3) Effect of the omission of elements N,P,K. & Ca.

As the plants grew, the total heights, number of internodes, number of mature leaves on the main stem and number of leaves shed were recorded separately for each plant every week. In addition the flowering time and the fruiting time, the number of fruits per plant and number of seeds per fruit were also recorded. In the case of omission of elements the visual symptoms were also noted, the data being recorded as mean of the readings for each treatment.

Of the three standard solutions tried the best growth was found in Hoagland and next in Knop's. The worst growth was found in Richards. There were some differences in the effects in the two species.

The sowing time showed certain differences in the relative effects of the three solutions though not very pronounced, and showed a comparatively better growth in the control grown in soil in pots in the later sowings than in the earlier. The flowering was in general slightly delayed in the mineral solutions.

The heights etc. in the solutions without N,P,K & Ca and the visual symptoms are recorded. These effects are similar in the two species.

30. A comparative study of the catalase activity of the petals and leaves of *Hibiscus rosa-sinensis*.

S. N. PATTANAIK, Sambalpur.

In the present investigation, catalase activity of the petals and young leaves of *Hibiscus rosa-sinensis* was determined in the morning, noon and evening of bright sunny days.

From the experimental data, it is clear that the catalase activity of the petals are less than the leaves. In case of the petals, the catalase activity increased (very slightly) in the noon but a sharp rise is obtained in the evening, when the flowers have started to fade. In case of the leaves the results obtained for catalase activity are different. In leaves the catalase activity is high in the morning and the values obtained in the noon and the evening are comparatively low.

31. A note on the tropisms shown by the aerial roots of Banyan.

N. K. TIWARY, Benares.

In this paper are recorded the author's observations on the tropic behaviour shown by the roots. Some of the roots grow along the surface of included lateral branches, instead of vertically downward, influenced by water trickling down the branches during the rainy season. Others grow vertically down, influenced by gravity. But the tips of these latter are always directed away from the direction of light rays & from a very characteristic feature.

Mycology and Plant Pathology

32. The chondriome in the genus *Phytophthora*.

B. S. MEHROTRA, Allahabad.

1. The chondriome of the vegetative mycelium of the following eleven species of *Phytophthora* has been investigated.

- (i) *P. Cactorum*. (ii) *P. Citricola* Saw. (iii) *P. Cryptogea* Pethybridge.
(iv) *P. erythrocephala* Pethybridge. (v) *P. Faberi* (Faber) Maubl. (vi) *P. hibernalis* Carno. (vii) *P. paeoniae* Cooper et Porter. (viii) *P. fagopyri* Takimoto. (ix) *P. arecae* (Coleman). (x) *P. Palmivora* Butler. (xi) *P. maidii* Merz.

All the three forms, e.g., granular, rod shaped and filamentous mitochondria are present in varying proportions and the fungi may be divided into five groups according to the kind of mitochondria present viz. :—

- | | |
|---|---------------------------------------|
| (i) Mostly granular | e.g. <i>P. Faberi</i> (Faber) Maubl. |
| (ii) Mostly rod shaped | e.g. <i>P. Cactorum</i> . |
| (iii) Mostly filamentous | e.g. <i>P. Citricola</i> Saw. |
| (iv) Granular & rod shaped mixed. | e.g. <i>P. arecae</i> (Coleman). |
| (v) Granular, rod shaped & filamentous mixed. | e.g. <i>P. cryptogea</i> Pethybridge. |

2. The mitochondria are seen as long, filamentous and slender bodies of varying length lying mostly parallel to the longitudinal axis and constantly moving under the influence of the cytoplasmic currents. At the tips they are granular in shape.

3. Janus green Höchst B and dahlia violet stain them, transforming them into vesicles. The vacuolar system and the mitochondria are stained simultaneously by using a mixture of neutral red and Janus green.

4. Of all the fixatives employed Helly's liquid and Sublimé formol gave good results. Liquid of Lenhossek (containing alcohol and acetic acid) did not produce any marked change.

33. Carbon requirements of the genus *Pythium*.

R. K. SAKSENA and B. S. MEHROTRA, Allahabad

1. The growth of the following species of *Pythium* on different carbohydrates and alcohols was quantitatively measured under controlled conditions :—

- | | |
|---|--|
| (1) <i>P. afertile</i> Kanouse et Humphery. | (9) <i>P. epiphanosporon</i> Sideris. |
| (2) <i>P. aphanidermatum</i> (Eds.) Fitz. | (10) <i>P. graminicolum</i> Subramaniam. |
| (3) <i>P. arrhenomanes</i> Drechsler | (11) <i>P. hyphalosticton</i> Sideris. |
| (4) <i>P. artotrogi</i> (Mont.) de Bary. | (12) <i>P. leucosticton</i> Sideris. |
| (5) <i>P. de Baryanum</i> Hesse. | (13) <i>P. mamillatum</i> Meurs. |
| (6) <i>P. de Baryanum</i> Pelargonii. | (14) <i>P. polymeron</i> Sideris. |
| (7) <i>P. deliense</i> Meurs. | (15) <i>P. spaniogamon</i> Sideris. |
| (8) <i>P. diameson</i> Sideris. | (16) <i>P. rhizophoron</i> Sideris. |

2. The fungi did not grow on medium lacking in the source of carbon.

3. Dextrose, maltose, sucrose and starch were found to be the best sources of carbon for these fungi.

4. The utilization of the polysaccharides was correlated with the ability of the organism to hydrolyze them.

5. In majority of the media containing various carbohydrates singly, the acidification was noticed with the growth of the fungus. But in case of media containing sucrose and starch the acidification was very little.

Economic Botany

34. Economic plants of the Darjeeling District.

KALIPADA BISWAS and JYOTIRMAY MITRA, Calcutta.

India is extremely rich in economic plants. Vavilov is fully justified in stressing that from the unknown cradle of the South Asia might be discovered many plants for our economic uses. The writers' long search and enquiry into the uses of hundreds

of useful Sikkim species of the district of Darjeeling leads to the discovery of marvellous medicinal effects of some of the indigenous species. Many temperate crops are also grown in the district and these were introduced and acclimatized in this hill region. Thorough investigation into the uses of these economic plants has been undertaken and the present paper deals with the most common species numbering about 50, of which very little is known.

35. Possibilities of the Manufacture of Rose Oil in India from the roses cultivated in India.

KALIPADA BISWAS and PROMODE RANJAN BANERJEE, Calcutta.

The Essential Oil Committee of the Council of Scientific and Industrial Research entrusted the senior author with the investigation on Roses. The bulk of the Rose Oil amounting to about Rs. 600,000/- used to come mainly from Bulgaria before the war. Here in this part of the Eastern Europe large plantations are set apart and rose oil is manufactured on a commercial scale. It is hoped that if rose oil can be manufactured in India it might be possible to encourage the rose growers to undertake extension of their rose plantations on a large scale and save waste of large quantity of petals by setting up small factories in the garden with a view to making India at least self-supporting to a considerable extent with regard to her needs of rose oil used for various purposes in trade.

The work is for the time being confined to Bengal and Bihar. There are about 6 species of commercial varieties sold in the market under cultivation at present apart from numerous varieties grown for the garden purpose.

Collections in Bengal show that wild species of Roses are *R. macrocarpa* & *R. sericea* Lindl. *R. macrocarpa* is an extremely valuable rose for texture and attempts are being made by horticulturists in U. S. A. and elsewhere to get a hybrid of a very high quality and price from this middle Himalayan rose.

Regarding the chemical aspect, a considerable percentage of Ascorbic acid (Vitamin C) has been detected in the hips of some particular varieties of rose from the Sonthal Pargana districts. Also a very efficient acid-alkali indicator has been isolated from the colouring matter of another particular variety of rose. Work on these aspects of the chemical investigation of rose are in progress.

36. South Indian seaweeds of economic value.

FRANCESCA THIVY and S. V. GANAPATI, Madras.

Because seaweeds supply necessary salts, including iodine compounds, in readily available organic form and furnish vitamins they should have a place among common foods. In China, Japan and the Hawaiian Is. over a hundred kinds are thus utilized. Luscious and wholesome "sea vegetables" of South India include green, brown and red algae.

Whereas *Gracilaria lichenoides* (L.) Harv. is the only agarphyte commercially employed in India, investigation shows seven other species, in three genera, yielding good percentages of agar, are available in abundance.

Textile sizars obtained from *Grateloupia* and *Acanthophora* are suitable for industrial adoption.

Padina, *Turbinaria*, *Cystophyllum*, *Sargassum*, *Hormophysa* as well as smaller algae thrown up in the wash have possibilities for fertilizer and stockfeed utilization.

Taxonomy of the species as well as methods of extraction and industrial uses of the phycocolloids dealt with are considered.

37. On the development of nodal bacterial root tubercles in the floating branches of *Neptunia oleracea* Lour.

T. J. JOB and FRANCESCA THIVY, Madras.

The plant is an aquatic perennial anchoring itself to the margins of tanks and producing densely growing floating branches. On the latter clusters of adventitious

roots occur which are suspended in the water and in each cleustr develop oval, pink tubercles about 1 mm. in diam. and 2 mm. long, singly or in groups. The soil roots exhibit only a few tubercles, which though similar to the others often growing larger become branched and turn dark brown in colour

The tubercles of both types of roots are found to be densely packed with rod-shaped and often curved or undulate bacteria about 0.7μ in diam. and 1.4μ to 7.0μ long. The plant being a member of the Leguminosae, the organism associated with the soil roots is presumably the symbiotic nitrogen-fixing bacterium, *Rhizobium radicicola*. Since the bacterium in the tubercles of the floating branches and that of the soil roots are morphologically similar, it is probable they are identical. Cultures of the bacterium are being grown on nitrogen-free media.

Probably *Neptunia oleracea* has vital significance in agricultural practice.

38. Some aquatic macrophytes of importance as fish forage.

FRANCESCA THIVY, Madras

In South India the macrophytic hydrophytes in fish ponds are, as a rule, limited to *Chara* spp., *Hydrilla verticillata* Presl., *Vallisneria spiralis* Linn., *Najas* sp., *Ceratophyllum demersum* Linn., *Nymphaea pubescens* Wild. and *Nelumbium speciosum* Wild. Great variety in diet is one of the striking facts about the feeding habits of fish and therefore increased numbers of species of forage aquatic plants should be impressed into the service of pisciculture.

At "Fishlands", Madras, the following hydrophytes which are useful as fish forage have been introduced into the ponds from other parts of the Province and North India : *Nasturtium officinale* R. Br., *Limnanthemum cristatum* Griseb., *Ipomaea aquatica* Forsk., *Ottelia alismoides* Pers., *Ottelia* sp., *Pistia stratiotes* Linn., *Lemna paucicostata* Hegelm., *Spirodela polyrrhiza* (L) Schelid., *Wolffia michelii* Schleid., *Wolffia microscopica* Kurz., *Najas graminea* Del., and *Lagerosiphon Roxburghii* Benth.

The ecology and methods of culture of the above species are discussed.

39. Aquatic vegetable gardening in fish farms.

FRANCESCA THIVY, Madras.

Most aquatic vegetables are neglected although in many of them are brought together both aesthetic appeal and special food values, such as, high content of calcium, phosphorus, iron, provitamin A, vitamin C or proteins. Production is economical in cost, labour and time.

Aquatic and semi-aquatic vegetables belonging to over a dozen different species have been grown at "Fishlands", Madras, including water-cross, amaranth, morning glory and garden mint.

The taxonomy, ecology, methods of cultivation, and collated food values relating to the above are presented.

40. Culture of *Bacillus radicicola* with the object of isolating a rapidly nitrogen fixing strain.

R. L. NIRULA, Nagpur.

It is hardly necessary to emphasise the importance of *Bacillus radicicola* which is so well-known. This has been the subject of a large number of investigations from different stand-points. The most important out of these is the soil inoculation or seed treatment with the organism and has a considerable economic value. The present work was started at Nagpur with the object of culturing *B. radicicola* on a large number of artificial media in the laboratory and isolating, if possible, strain or strains which would be "fixed" i.e. undergo no loss of virulence or vitality and possess the ability of fixing larger quantity of atmospheric nitrogen.

The pea plant was used for the investigation and eight strains have been isolated from a parent strain that originally came from a single cell. Two of these are "fixed" and grow more actively. These might prove to be the requisite ones. The different strains including the parent were cultured on a large number of media. They showed several colony differences and differed in the liquid media with regard to the speed of their reactions; but in respect of the nature of these they were fundamentally similar. The results obtained so far appear to be very hopeful in the direction of evolving a quick nitrogen fixer and in the direction of solving the perplexing question of species.

The methods used during culturing were, in addition to the poured plate and Dr. Paine's and Burri's method as modified by the writer for the isolation of single cells, those employed ordinarily in mycological studies.

The different strains had always originated as sectors in the parent colonies or those of the strains on solid media.

41. Inter-specific and Inter generic crosses between *Luffa* and *Trichosanthes*

R. H. RICHHARIA, Sabour, Bihar

Inter-specific cross between *L. aegyptiaca* and *L. acutangula* has been made and the F_1 used as $\overset{O}{+}$ to cross *Trichosanthes angnia* which also succeeded. It may be added that attempts to cross *T. angnia* with either of the parents viz., *L. aegyptiaca* and *L. acutangula* did not succeed.

SECTION OF PHYSIOLOGY

PRESIDENT : DR. BASHIR AHMAD, M.Sc., Ph.D. (Lond.).

Pharmacology

1. Pharmacology of Polyporin—A preliminary report.

B. B. ROY and B. MUKERJI, Calcutta.

Polyporin represents the culture-filtrate of *Polystictus sanguineus* grown in various media (Bose, S. R., Bull. Bot. Soc., Bengal, April, 1947). Three different filtrates (F. 163—Broodlac medium; F. 164—Wheat husk medium; F. 168—Paddy husk medium) have been studied. In intact anaesthetised (urethane) animals (dogs and cats), the filtrates produced, in moderate doses (0.25 to 0.5 cc./kg. intravenously), only a slight fall of blood pressure, returning quickly to normal. Heavier doses caused a slightly increased fall in pressure, which, however, was not significant (10 mm. of Hg. with 1 cc./Kg.). In the *spinal cat*, the fall in blood pressure was comparatively greater (about 20 mm. of Hg.). Of the three filtrates tested, F. 164 caused the greatest, and F. 168 the least amount of fall. The respiratory effects followed closely the blood pressure changes showing augmentation during the period of fall returning to normal with the restoration of the pressure to the original level.

No untoward symptoms were observed when the different filtrates were injected intravenously in unanaesthetised rabbits in doses of 1 cc./Kg. Neither was there any effect when the filtrates were instilled in the rabbit's cornea. Virgin guineapig's uterus was indifferent to the action of the crude filtrates in isolated bath experiments.

The changes noted above do not appear to arise from polyporin itself since comparable results were obtained with the administration of the respective blank media alone.

2. A Note on the Pharmacology of *Securigera Securidaca*.

M. L. CHATTERJEE and B. K. GHOSH, Calcutta.

A bitter principle from chloroform extract of the drug was isolated by S. Ghosh and N. N. Ghosh and its pharmacological action was studied by P. De. Besides the bitter principle contained in the chloroform extract of the drug, another bitter principle has been found in the alcoholic extract which was isolated and the pharmacological action was studied in cats under chloralose and urethane anaesthesia and under spinal operation.

Dose used was 0.05 mgm/kgm to 0.5 mgm/kgm.

This bitter principle acts by direct stimulation of the plain muscle of blood vessel and raised the blood pressure but is depressant to the cardiac action. Urethane seems to add to the toxic effect of the principle on the heart.

Its action on uterus and intestine is by stimulation of activity.

The seat of action of this bitter principle is different from the other principle studied by Ghosh & De.

3. On the Assay of Liver Extracts.

A. N. BOSE, Baranagar, Calcutta.

There is no definite laboratory method for evaluating the potency of a liver preparation meant for parenteral administration. An investigation has, accordingly, been carried out for finding out an idea regarding the efficacy of liver preparations by administration into guineapigs of definite weight put up in uniform fixed diet. Animals whose reticulocyte percentages show minimum fluctuation and vary between 0.5 to 0.8% were selected and injected with various preparations. Counting was followed for 7 successive days, and the days after injection of minimum quantity of the preparation that gave the optimum response were recorded.

In our hands the above assay of a liver preparation is giving a fair indication of the potency of a liver extract whether made from the whole liver, by fractionation or by proteolysis.

4. Phytopharmacological Studies of Gonadotropic Hormone in the Pregnancy Urine.

J. S. CHOWHAN, Calcutta.

A mention has been made in Ayurveda, on the determination of pregnancy in different stages by the use of pregnant woman's urine as a manure on black horse gram grown in earthen pots. Some interesting study has recently been made on the effect of menotoxin, leprosy serum and vegetable alkaloids on the growth of young seedlings. A study on the effect of gonadotropic hormones present in the urine of pregnant women was taken up in this laboratory on the above lines. So far it is seen the gonadotropic hormones appear to have some effect on the rate of the growth of the seedlings. It cannot be stated at present if the above study will be a substitute to the well known Aschheim and Zondek test and the Friedmann test. The advantage of this test will be that the results could be obtained within 24 to 48 hours and no animal life will be sacrificed.

5. Effect of common salt on gastric secretion.

BINDESI PROSAD SINHA, Laheriasarai, Darbhanga.

An experimental study on the Pavlov and Heidenhain pouch dogs on the effect of common salt (1.5 gm) orally, demonstrated an inhibitory effect in the quantity of the gastric juice, thus differing from the secretagogue behaviour of sodium chloride (Babkin). On further observation of the associated impurities present in the common salt independently, it was found out that the magnesium chloride and calcium chloride particularly were responsible for the inhibitory effect of common salt. Calcium chloride itself in 1.5 gm. oral administration had a remarkable inhibitory effect in both the quality and quantity of the gastric juice.

6. Effect of atropine sulphate on gastric secretion.

BINDESI PROSAD SINHA, Laheriasarai, Darbhanga.

An experimental study on the effect of Atropine Sulphate by parenteral route, on the combined observations on Pavlov & Heidenhain pouch dogs and on Heidenhain dogs alone, had a marked inhibitory effect in the quality and quantity of the gastric juice, in both the conditions. In Pavlov animals alone, it was usual to have so, whereas in Heidenhain (due to non-existence of vagi), the observation was unusual. An interesting conclusion was made that in Pavlov, atropine sulphate prevented the entrance of acetylcholine into the main stomach, so there was an inhibition in quality (in acidity) and quantity of the gastric juice, obtained through the pouch. Whereas, in Heidenhain acetylcholine was not liberated due to non-existence of parasympathetic innervation or the usual amount of acetylcholine formation was going and was not acting in the pouch due to atropine sulphate.

7. India Aconite.

R. C. GUHA, Calcutta.

Aconite is considered to be sufficiently important drug to be included in the Indian Pharmacopoeial List, 1946, by the Government of India from the Department of Health. But as not much data is available on the Indian Aconite, only characters, acid-insoluble ash content & biological assay without any standard, are given in the monograph. Therefore the monograph for Indian aconite requires further data for the complete evaluation of the drug. In the present investigation, a standard has been suggested on the basis of the chemical analysis of the different varieties of the drug. At least 70 species of aconite are known to be grown throughout the world and of them generally 6 or 8 species of aconite occur on the Indian market. Since various considerations have been emphasised by many workers that the physiologically active constituents of the numerous species of aconite require separate and special investigation, six different varieties were collected from the Indian market for the complete chemical analysis of the drugs to the toxicity of the drug. It was reported (Report of Poisonous Sub-Committee, 1942) that more consistent results obtained when assays were based upon the total alkaloidal content rather than the ether-soluble portion.

The average total alkaloidal content of the six different varieties of Aconite was found to be 2.1%, the maximum concentration 3.11% was being observed in the case of *Aconite chasmanthum* while the average acid-insoluble ash was found to be about 0.52%. Therefore it was suggested that the total alkaloidal content calculated as aconitine should be not less than 1.0% & acid-insoluble ash should be not more than 0.5%. Further work is in progress.

8. The effect of 4 : 4'—Diamidino Stilbene on the Nucleus of the Fifth Nerve of the Rhesus Monkey.

P. C. SEN GUPTA, Calcutta.

The lesions compatible with the clinical features of Diamidino stilbene Neuropathy in man have been produced in the rhesus monkey.

9. Benadryl—in the Treatment of Viper Bites.

J. S. CHOWHAN, and D. P. GHOSH, Calcutta.

In our previous studies the injection of pituitrin and veritol has been advocated in the treatment of acute and chronic Viper Venom poisoning or after the secondary shock that follows Viper bites. The Viper Venom acts mainly on the circulatory system and the collapse that follows is histamine-like in nature. Benadryl (beta-dimethylaminoethyl benzhydryl ether hydrochloride) is reported to have a remarkable anti-histaminic activity. The effect of Benadryl was tried in collapse produced by Russells Viper Venom in experimental animals. The blood pressure returned to normal and the respiratory distress was relieved with small doses of Benadryl, injected intravenously in such animals. Benadryl could neutralise the effect of Viper Venom when injected mixed with the venom or when it was injected immediately after a big dose of viper venom.

It is suggested that Benadryl in doses of 50 to 100 mg. by mouth and injected intramuscularly or even intravenously will be useful as an antidote in the case of Viper Venom poisoning in human beings.

10. The Therapeutic Use of Sea Water in Scabies and Other Skin Conditions.

J. S. CHOWHAN, Calcutta.

Quinton and Macallum, long ago, pointed out that in a great majority of animal the circulatory fluid and the body juices, from its inorganic composition, is but a representative of sea water. The present terrestrial and the avian lives are but descendents of forms that once lived in the sea. In view of the above observations that the sea water and the body juices are allied in their Na, K, Ca and Mg constituents, the parenteral use of sea water was tried and found useful in cases of mental disturbances, canine mange and ring worm in animals. Deep subcutaneous injections of sterile sea water in doses of 2 to 3 c.c. were injected daily in patients suffering from Scabies. In 280 cases so far treated with different doses of sea water 34.3% showed a clinical improvement and 28.5% showed marked improvement. The improvement was noted in the shape of relief in severe itching, drying up and scabing of the rash and later on peeling off of the rash. Sea water therapy promises to be useful in many other skin and general conditions. It has the advantage over the time old sulphur treatment that the treatment is not messy and the resources of the drug are enormous and easily available. The treatment is harmless.

11. Toxic symptoms due to rauwolfia serpentina

NAGENDRANATH DE Calcutta.

Rauwolfia serpentina has no official dose. It has been used for a long time in the indigenous systems of medicines in India. Recently it is being largely used in cases of high blood pressure and some mental diseases. The dose used for high blood pressure is about 70—100 grains of the powdered root or the corresponding amount of the total alkaloid liquid extract daily. The dose for mental diseases is about 3 times as much. Toxic symptoms are often observed with these therapeutic doses.

Parkinsonism is one of these toxic symptoms. Bradycardia and congestion of the face, conjunctiva and nasal mucous membrane are others. The action of the drug on the human system is mainly one of depression. Depression of the brain specially at the subcortical level is probably the cause of the beneficial action of the drug in mental diseases. Extreme depression of the globus pallidus is perhaps responsible for the parkinsonian rigidity. Slowing of the heart and congestive phenomena are likely to be due to depression of the sympathetic nervous system.

Biochemistry and Analytical Chemistry**12. A Chemical Method of Estimation of Nicotinic Acid in Urine in the presence of Sugar.****SACHCHIDANANDA BANERJEE and NARESH CHANDRA GHOSH, Calcutta.**

Various methods have been proposed by different workers for the estimation of nicotinic acid in urine by König's reaction. When all these methods were tried in the urine of diabetic patients it was impossible to estimate the nicotinic acid of the urine due to the interfering colour which was produced after digestion of the urine due to the charring of the sugar present. In studying the nicotinic acid nutrition of diabetic patients a method for the estimation of nicotinic acid in urine in the presence of sugar was necessary. The method developed by us is as follows: Sugar in the urine is quantitatively estimated with Benedict's reagent. To 25 cc. of urine in a 250 cc. beaker is added 8 cc. of concentrated hydrochloric acid. The beaker is heated in a water bath and is treated with 10 per cent potassium permanganate until all the sugar is oxidised. The manganese present in the solution is removed as phosphate by treatment with disodium hydrogen phosphate and caustic soda. The solution is then digested in water bath for 45 minutes with 40 per cent caustic soda so that the strength of the alkali is 4 per cent. Interfering colour is removed by making the solution acidic with concentrated hydrochloric acid and treating with potassium permanganate solution until the solution becomes almost colourless. The solution is adjusted to pH 7, phosphate buffer is added and the precipitate formed is filtered. An aliquot of the filtrate depending on the amount of nicotinic acid present is taken for the colorimetric estimation of nicotinic acid.

13. Effect of Nicotinic Acid Amide on Blood Sugar and Blood Acetone Bodies of Diabetic Patients and of Normal Subjects.**SACHCHIDANANDA BANERJEE and NARESH CHANDRA GHOSH, Calcutta.**

Contradictory reports appear as to the efficacy of nicotinic acid in the treatment of diabetes. In view of the conflicting reports and in view of the observation that nicotinic acid prevents the diabetogenic action of rabbits and rats as shown by Banerjee (*Science*, 1947, 106, 128) it was thought desirable to study the effect of intravenous injection of nicotinic acid amide on the blood sugar and blood acetone bodies of diabetic and normal subjects. 500 Mg. of nicotinic acid amide in a 10 per cent solution was injected intravenously in 17 diabetic and 6 normal subjects fasted overnight. Samples of blood were taken before and at intervals of half an hour upto two hours after the injection. Blood sugar and total blood acetone bodies were determined and it was found that nicotinic acid amide had practically no effect on the blood sugar and blood acetone bodies in diabetic and normal subjects.

14. Anti-Diabetic Sugar.**PRAHLAD ROY and DIPTENDU GANGULY, Calcutta.**

The result of investigations in the Indian Institute for Medical Research indicates that Sucrose or Glucose when treated with milk of lime and phosphoric acid is absorbed and utilised by animal or human system under diabetic conditions, unlike normal sugar or sugars subjected to any other treatment with milk of lime and carbonic or sulphurous acids.

In normal system the rate of absorption of the Treated Sugar (milk of lime and phosphoric acid) has been found to be more rapid than in the case of the ordinary sugars.

Further study is being made to compare the difference between the hepatic glycogen reserves of the animals after administering the Treated and Normal Sugars.

15. Deterioration of the Vitamin B₁ Content of Malt-Extract Stored in the Tropics.**N. K. IYENGAR and B. MUKERJI, Calcutta.**

2 standard samples of Malt extract with vitamin B₁ contents of 300 and 200 I.U. per gram respectively were stored in the laboratory for a period of one year from October 1946 to 1947 covering all the seasons of the year. They were tested

periodically by employing the Decalso adsorption method once in 2 months and a progressive deterioration was observed. At the end of one year a loss of nearly 40 per cent was recorded. The malt extracts were prepared by evaporating in vacuum at a temperature of less than 50 °C. A sample of malt extract prepared by evaporating at a temperature of 85°C and whose vitamin B₁ content was 125 I.U. per gram, was also tested for deterioration when stored under similar conditions. At the end of one year the loss in this case was only 25 per cent. This is probably due to the destruction by heat in the latter case of enzymes present in malt extract, capable of inactivating vitamin B₁.

16. Protective factors for Vitamin C in green-gram (*Phaseolus radiatus*).

SUDHA DEVLALKAR and K. V. GIRI, Bangalore.

The occurrence of enzyme systems and other factors which influence the formation and destruction of vitamin C in green gram during germination has been investigated.

The results indicate the occurrence of the following factors in the seed.

1. A reducing system which reduces dehydro-l-ascorbic acid into ascorbic acid in the absence of added glutathione in the intact seed during germination. In presence of dehydro-l-ascorbic acid therefore more vit-C is formed during germination.

2. An oxidative factor which oxidises vitamin C. This factor develops during germination.

3. A protective factor which protects vitamin C against autoxidation and copper oxidation but not enzymic oxidation. In germinated seeds, as a result of the action of the oxidative factor on vitamin C the protective action of the factor is not very pronounced. Destruction of the oxidative factor by boiling however enhances the protective action.

Further investigation on the inter-relationship between these factors with respect to the formation and destruction of Vitamin C during germination of green gram and other pulses is in progress.

17. Effects of light and manganese on the synthesis of ascorbic acid and ascorbic acid oxidase during germination of cereals.

INDERJIT and BASHIR AHMAD, Delhi.

Light has been found to have a striking effect on the synthesis of both ascorbic acid and ascorbic acid oxidase during the germination of barley, green gram, millets and Bengal gram. Both these increased side by side and the increase was further augmented by the presence of a trace of manganese.

18. Preliminary observations and discussions on biochemical findings in human cases of liver cirrhosis with particular reference to choline content in blood.

A. DAS, S. M. BANERJI and R. SUBRAHMANYAM, Cuttack.

Biochemical changes in blood in clinical cases of liver cirrhosis at the Orissa Medical College Hospital have been investigated and diminution of blood proteins, reversal of albumin-globulin ratio and marked diminution of lipide phosphorus have been found. The significance of the last change is discussed and the estimation of lipide phosphorus is suggested to determine the choline deficiency. Further investigation in these lines may lead us to a new liver efficiency test in cirrhosis of liver. Etiogy of liver cirrhosis in human cases may be due to lack of choline in diet and choline therapy is therefore suggested as a rational treatment.

19. Enzyme Destruction and Color Retention in Dried Prunes.

C. N. CHARI, C. P. NATARAJAN, H. J. PHAFF and E. M. MRAK, California.

Dried prunes removed from the dehydrator at a moisture content of 30 to 32 per cent and packed in moisture proof containers with propylene oxide to prevent microbiological deterioration will discolor and attain an off flavor. Experiments were conducted to determine factors involved in the development of off flavor and discoloration. It was observed that peroxidase is responsible in part at least for these changes. Prunes were dehydrated under various conditions of counter flow and

two-stage systems of drying in an effort to destroy the peroxidase enzyme. Thermocouple measurements were made to follow the temperature of the prune flesh near the pit. Even though the flesh was heated to over 200° F. several hours during the two-stage drying, the enzyme was not completely destroyed. In view of this the possibility of obtaining enzyme destruction by changing the system of dehydration was abandoned, and steam blanching of the freshly dried prune was tried. It was found that peroxidase in freshly dehydrated prunes containing 30 to 32 per cent moisture could be inactivated by blanching the fruit in live steam for about 6 minutes. Thermocouple measurements indicated the temperature of the prune flesh was all above 200° F. in this period of time. Tests for the presence of catalase, phenolase and peroxidase indicated that these enzymes had been inactivated by the treatment. The fruit was then packed in moisture proof bags, treated with propylene oxide to prevent microbiological deterioration. After a period of storage for 3 months at 80° F. the color and flavor retention of the blanched samples were much superior to those of the unblanched samples. The procedure is recommended as a method of production and packing of dried prunes of a superior quality.

20. On the measurement of the Proteolytic activity of Enzymes.

N. ROY, Baranagar, Calcutta.

Various methods are now known for the determination of the proteolytic activity of the enzymes pepsin, papain and trypsin. The methods should indicate the nature of the enzymic activity as a protein may be degraded from protein through various stages to amino acids. In routine procedure however an easy method for estimating the liquefying power of a proteolytic enzyme is of more significance for commercial evaluation.

The method of estimating the liquefying power of pepsin, papain and trypsin against casein has been simplified and relative unit has been (66, 13 and 25 respectively) indicated for each enzyme.

21. Effect of long continued administration of some fat metabolism products on the potency of pancreatic insulin of guineapigs.

M. C. NATH and H. D. BRAHMACHARI, Nagpur.

Intermediary fat metabolites such as hydroxy butyric acid & aceto-acetic acid when injected into normal guinea pigs in the form of their Sodium salts, have been found to cause decrease in the potency of their pancreatic insulin.

Insulin was extracted from the pancreas of the experimental animals at regular stages and assaying was done on normal rabbits according to the usual method.

Though during the 1st stage of the experiment a considerable rise in the potency of the pancreatic insulin was observed in the experimental animals, the insulin potency was found to be greatly decreased after a period of about 2 months' injection.

22. The milk-coagulating enzyme of the latex of *Ficus carica* Linn.

C. R. KRISHNAMURTI and V. SUBRAHMANYAN, Bangalore.

A systematic search among plant sources for a suitable substitute for rennin was carried out and the latex of *Ficus carica* Linn (Edible fig) was found to be a very promising source. Freezing of the latex filtrate followed by quick evaporation under vacuum gave best yields of enzyme of very high activity. Preparations capable of coagulating nearly a million times their own weight of milk under optimum conditions were obtained. The physico-chemical properties of the enzyme and kinetics of milk coagulation were studied. The enzyme was found to be more versatile than animal rennet. Of special interest was its positive coagulating effect on vegetable milks like those from soya-bean which failed to respond to the action of animal rennet. The plant enzyme gave cheeses comparable in texture and qualities to those made out of animal rennet.

23. The Proteolytic Enzyme of the latex of *Ficus Carica* Linn.

C. R. KRISHNAMURTI and V. SUBRAHMANYAN, Bangalore.

Although the enzyme preparation from the above latex was several times more active than the best available brands of animal rennet, it gave cheeses which developed slightly bitter taste after ripening. The bitter taste was found to be due to the products of proteolysis resulting from the action of a protease component in the enzyme

preparation. With a view to ascertain the nature of the protease and to devise methods of suppressing its pronounced action in cheese-making the enzyme was studied in detail.

The enzyme gave characteristic protein reactions and was found to resemble papain in ultrafiltration, diffusion and dialysis studies. Unlike papain, however, it had no blood-clotting action. The enzyme was found to be tryptic in nature and was active on casein, edistin, egg-albumin, haemoglobin, peptones and synthetic substrates like Hippurylamide. The urea denatured proteins had a higher degree of digestibility than the aqueous solutions of proteins. The digestion of casein and haemoglobin both in water and urea were found to be second order reactions. Temperature inactivation of enzyme was also a second order reaction. The behavior of the enzyme towards oxidizing and reducing agents was similar to that of papain.

By fractional precipitation of the enzyme with alcohol the enzyme components could be separated. The milk-clotting, casein-splitting and gelatinase activities increased with the nitrogen content of the fractional precipitates, whereas, the peptonase activity diminished with the nitrogen content.

24. Effect of feeding thyroidal and antithyroidal substances in sheep.

D. N. MULLICK, Izatnagar.*

Weekly blood was analysed for haemoglobin, sugar and serum for protein, fat, calcium, phosphorus and magnesium in thyroidectomized and control animals for thirteen weeks. Standard methods were followed with the progress of time after operation all the constituents in experimental animals changed but the fat content in serum decreased significantly. Now the experimental group was fed with synthetic thyroprotein at 1gm/100 lb body weight for 3 weeks and afterwards the dose was increased to 2g/100 lb body weight. All the constituents were analysed and the fat content in serum was still reduced. The control animals were supplemented with thiouracil at 8g/100 lb body weight for 5 weeks. All the constituents were analysed and the fat content was increased considerably and the change was significant. From these observations we concluded that the fat in serum could be properly utilised for the actual doses of thyroidal and antithyroidal substances in order to avoid the bad effect in animals health.

25. A Preliminary Study of the Deterioration of Water Soluble Alkaloids of Ergot.

B. K. GHOSH, Calcutta.

It has been found that the Ergot preparations are liable to lose their activity along with their age. As the therapeutic activity of Ergot depends mainly on the contents of the specific alkaloid, we thought it desirable to ascertain the factors responsible for its deterioration under controlled conditions.

Wokes, Elphick, Thomson, Mukerji and others have already studied the deterioration of water insoluble alkaloids of Ergot under various conditions. In order to study the rate of deterioration of water soluble alkaloids 0.1% Ergometrine in 1% tartaric acid was freshly prepared and was kept in well stoppered bottles in cool room, in room temperature and in incubator. Each sample was tested for its Ergometrine content at the interval of a month and a half. Some foreign preparations Ergometrine was similarly treated and the rate of deterioration was noted. To study the rate of deterioration of water soluble base of Ergot in sun light, a solution of Ergometrine was prepared and it was exposed to sun light in three different coloured bottles. Each sample was subjected to frequent testing for its alkaloid content. In course of a month the alkaloidal content in the samples came down from 100 mgs. to 45 mgs. (in dark blue bottle), 100 mgs. to 24 mgs. (Amber coloured bottle), 100 mgs. to 6.5 mgs. (white coloured bottle).

These observations indicate that the rate of deterioration of water soluble alkaloids not only depends on temperature but also on the nature of the container.

*This work was done in the department of Physiology, Michigan State College, East Lansing, Michigan, U.S.A.

26. Chemical Investigation of the Natural Fruit-body of the Fungus—*Polystictus Sanguineus* (L) Mey.

N. K. SEN and P. R. BANERJEA, Calcutta.

A chemical analysis and study of the antibacterial activity of the natural fruit-body of the fungus *P. Sanguineus* have been made. When subjected to extraction with various solvents, it gave fractions of varying antibacterial action. Water and ether extracts of the fresh fruit-body yielded a product with acid character (pH, 4.4) possessing maximum antibacterial activity against typhoid bacillus and staphylococcus aureus.

The active substance called "Polyporin" was found to be thermostable and non-volatile (Nature, 1946, 158, 295). Sodium salt of the antibiotic was prepared, which retained its activity against typhoid bacillus for a long time.

Petroleum ether extracted a mixture of hydrocarbons and some colouring matter. The chloroform extract was found to contain two pigments, one red and another yellow and the presence of flavone was detected in the yellow portion.

Further work is in progress.

27. Estimation of Quinine in Small Quantities Employing its Fluorescence as Indicator.

I. B. BOSE and A. BHATTACHARJI, Calcutta.

Quinine sulphate solution in dilute sulphuric acid exhibits strong fluorescence in ultra-violet light. When sulphuric acid in excess of that required for the formation of quinine sulphate $(C_{20}H_{24}N_2O_2)_2H_2SO_4$ is just neutralised by sodium hydroxide solution marked decrease in the fluorescence is observed.

The possibility of employing this sudden and significant change in the fluorescence, as an indicator for the neutralisation of the sulphuric acid in the estimation of quinine by titration after extraction in a pure form from its pharmaceutical preparations, has been investigated in this paper.

Pure quinine sulphate in quantities of 10 mgs. has been estimated by the above method after extraction with chloroform in the usual way. When titrating the excess of sulphuric acid against sodium hydroxide, the ultra-violet lamp was so adjusted that the vertical beams fell on the quinine solution in the beaker. The end point was reached when the first significant change in fluorescence was observed.

Over a dozen quinine sulphate solutions in varying quantities representing from 5 to 30 mgs. of quinine were assayed by this method and the recovery was found to be almost quantitative, the deviation ranging between 0.7 to 4 per cent. In order to test how far this method is applicable for quinine solutions containing small quantities of strychnine and other ingredients (as ordinarily found in pharmaceutical preparations), assay was carried out in solutions of quinine sulphate to which strychnine in proportion of 2 to 3 per cent. of the quinine present was added it was found that strychnine if present in such small amounts, the estimation of quinine is within the allowable errors, although the deviation in this case (5 to 9 per cent.) was slightly higher than in quinine solutions alone, which is normally to be expected.

28. A Study on the Fluorescence of Kayara Gum, Tragacanth, Acacia and their Preparations, in Ultra-Violet Light.

I. B. BOSE and J. N. MUKHERJEE, Calcutta.

The fluorescence of some gums in various forms, and of their preparations when exposed to ultra-violet light from Hanovia-Muir Quartz Analytical lamp with nickel oxide filter has been studied with a view to ascertain how far this technique can be applied for this evaluation and for the detection of the nature of adulteration if any.

The three gums Karaya (*Sterculia urens*), Tragacanth, and Acacia both in solid and powdered forms showed strong fluorescence. Their aqueous mucilages and other preparations were also fluorescent though less than the original gums. The fluorescence was found to decrease when stored for very long periods, particularly genuine old museum specimens.

Soluble gums when incorporated in aqueous preparations showed less fluorescence, but when acidified a considerable increase in fluorescence was observed which, however, was reduced when made alkaline. The insoluble portions of these aqueous mucilages were strongly fluorescent if at all.

In order to test the application of this method for grading samples of gums, three samples of Karaya gums (*Sterculia urens*) found to be genuine by other tests were exposed to ultra-violet light and all of them showed bright bluish white fluorescence almost of equal intensity. Three samples of Tragacanth Powder classified as (i) fairly good, (ii) medium and (iii) bad, on the basis of other tests were examined for their fluorescence and were found to have fluorescence in descending order according to their quality. Some pharmaceutical preparations containing karaya gum were also examined, which showed fluorescence of varying colour and intensity as they were composed of various ingredients some of them having their own characteristic fluorescence.

Nutrition

29. Protein intake in Orissa.

K. SUBRAHMANYAM and S. M. BANERJI, Cuttack.

The nitrogen partition in the urine of a number of Oriyas selected at random, was done. It was found that the total nitrogen and urea nitrogen were very low and the percentage of urea nitrogen was 65% indicating that the protein intake here is much below the recommended dietary allowance. Further, estimation of uric acid and phosphate revealed that the diet is also very poor in purine compounds.

30. The nutritive value of the fat in Ground-nut milk.

H. S. R. DESIKACHAR, S. S. DE and V. SUBRAHMANYAN, Bangalore.

The milk prepared from groundnut contains about 3.5% fat finely dispersed in the emulsion. The nutritive value of this fat compared with the fat present in cow's milk was determined by growth experiments on rats. The milks were fed as a sole source of fat to comparable groups of rats which received a fat-free basal ration adequate for growth in all respects. Vitamin A and D were also supplied along with the basal ration.

Since the type of carbohydrate in the basal ration influences the nutritive value of the fat, two types of basal diets were chosen. One contained predominantly lactose as the source of carbohydrate while the other contained starch. The feeding experiment lasted for two months. The average increase in weight per gram of intake of fat were 2.45 and 2.51g for groundnut milk and cow's milk respectively on the lactose diet and 2.51g and 2.64g respectively on the starch diet. The results therefore show that when the diet is otherwise adequate groundnut fat finely dispersed in the emulsion is about as nutritive as cow's milk fat.

31. High f.f. A. of Indian Edible oils (Groundnut).

K. RAMAMURTI and B. N. BANERJEE, Bangalore.

The f.f.A. of Indian edible oils put on the market (unrefined) is very high. Refined oils are better in that, colour, flavour, and acidity are removed. There is no limit in the municipal or food laws to prohibit the sale of high f.f.A. edible oil. It is well known that rancid oil and fats destroy vitamin in foods and retard the digestion and absorption of the fat or oil. It is very important that scientific data on the subject be collected, experiments carried out and food laws passed to ensure the sale of only wholesome edible oils and fats. Bazar samples in Bangalore (25) of groundnut oil has acidity 1 to 7%, average 3% to 4%. Pancreatic digestion trials showed that an acidity above 1% is undesirable. It is possible to prepare such oil if fresh, healthy nuts are used and damaged, split, broken, and mouldy kernels are carefully removed. Experiments on the destruction of carotene-vitamin A with such oil in food *in vitro* and *in vivo* are in progress.

32. Vitamin A acetate for Fortification of Edible Fat.

U. P. BASU, Baranagar, Calcutta.

Edible fat is largely used as a medium for the introduction of vitamin A in the System. But as the vitamin is susceptible to oxidation, its potency on storage must be

ensured. Ethyl gallate is a satisfactory antioxidant in affording marked protection against oxidation, and vitamin A in the form of ester is again being found to be less susceptible to oxidation; accordingly it was considered that if cow's ghee, or, "vegetable ghee" be fortified with vitamin A acetate instead of the usual vitamin A concentrate which is an alcohol, the stability of the vitamin in the fortified fat would be considerably increased.

This expectation has been fully realised from a study on the respective fall in vitamin A potency in preparations of cow's ghee and hydrogenated oil made with both vitamin A concentrate and vitamin A acetate. The incorporation of ethyl gallate (0.05%) further helps in retarding the loss of vitamin A potency in the fortified fat. It is being concluded that in any fortification of edible fat use of a vitamin A ester would be helpful in prolonging the stability of the vitamin potency on storage.

33. Protein Hydrolysate for Oral Use.

S. K. GANGULY, Baranagar, Calcutta.

The use of amino acids by mouth is therapeutically desirable as it avoids the necessity of protein digestion and permits absorption without difficulty in patients suffering from various disorders. But as the synthetic amino acids are costly, alternative lies in preparing a mixture of acids by partial enzymatic hydrolysis of protein bodies rich in essential amino acids and other food factors, vitamins and salts.

A method has been devised by which a palatable mixture might be obtained by hydrolysing casein and ground-nut meal with papain and a polyezyme (obtained from *Aspergillus oryzae*). The preparation is quite palatable when particularly taken with lemon or orange juice. On dry basis it contains :—

Protein (Nitrogen $\times 6.25$).....	59.87 %
Total Nitrogen	9.57 %
Amino Nitrogen	3.86 %
Ether Extractives	0.50 %
Ash	8.46 %
Carbohydrate	28.47 %

The product is rich in tryptophane, methionine, histidine, arginine, lysine, tyrosine, vitamin 'B' complex, and minerals, viz, iron, calcium and phosphorus.

34. Influence of Different Levels of Copper Intake on the Metabolism of Carbohydrate, Nitrogen, Calcium & Phosphorus.

K. SAHAI and N. D. KEHAR, Izatnagar.

A study of the metabolism of various nutrients conducted on kumauni bullocks at four different levels of copper intake viz. 12.31, 17.76, 20.24 & 63.28 mg per animal per day was made. Ration consisting of wheat bhusa and rape cake given to the animals, although making an adequate provision for the major nutrients, fell short with respect to copper. The total dry matter consumption and its digestibility coefficient remaining unaffected, the intake of dry matter per lb body weight gain decreased with increasing intake of copper, reaching a minimum with an intake of 7.38 mg of copper per 100 lbs live weight per day and increased again with the next higher level.

The digestibility coefficient of protein declined extremely slowly but nevertheless steadily with increasing intake of copper.

The retention of copper increased steadily with increasing ingestion of copper. The retention of Nitrogen, Calcium and Phosphorus improved with increase in the ingested copper rising to a maximum with an intake of 7.38 mg of copper per 100 lbs live weight per day and decreased again with the next higher level.

The total excretion of copper was found to closely parallel the intake, while the total excretion of N, Ca & P did not appear to be affected. By far the greater proportion of all the nutrients was excreted in the faeces.

35. Studies on the Metabolism of Copper, Nitrogen, Calcium, Phosphorus and Magnesium in Relation to Fluorine Intoxication in Cattle.

K. SAHAI and N. D. KEHAR, Izatnagar.

Kumauni bullocks were fed on a ration which was adequate in all major nutrients, Fluorine at the rate of 3 mg per kg live weight was administered. After about a year when the symptoms of fluorine poisoning were clearly manifested, a metabolic trial was conducted. The results showed (1) a decrease in the total dry matter consumption (2) an increase of 33 per cent in the minimum copper requirement of animals (3) a negative balance of N, Ca and copper and (4) a just barely positive balance for Mg.

36. Effect of Progressive maturity on the Cobalt Content of Some of the Indigenous Grasses and Leafy Fodders.

S. N. SINGH and N. D. KEHAR, Izatnagar.

The cobalt content of 16 grasses cut at four different stages of their maturity was determined. Majority of the samples were found to exhibit an uninterrupted fall in their cobalt content with the progress of maturity; whereas the rest an increase at the second cut to be subsequently followed by a continuous decline. The cobalt content of the three bimonthly loppings of 18 tree leaves were superior to grasses.

37. The Cobalt content of Some of the Common Animal Feeds.

S. N. SINGH and N. D. KEHAR, Izatnagar.

In view of the growing importance of cobalt in the nutrition of ruminants a large number of straws, grasses and concentrates were examined for their cobalt content. The amount of cobalt in as many as 60 samples of straws has been found to range between 0.01 and 0.111 part per million of the dry matter. Practically 33 per cent of these samples contained cobalt below 0.04 parts per million—its critical concentration in pastures according to the New Zealand workers. Grasses exhibited a narrower range of cobalt than the straws, all the 30 samples examined, lying within 0.028 to 0.75 parts per million. Twenty concentrates including cakes, grains and seeds and their by-products exhibited a range of 0.025 to 0.105 parts per million of cobalt. However 85 per cent of these concentrates indicate a range which corresponds to the proposed adequate range of cobalt in pastures of New Zealand and Australia.

38. Effect of Progressive maturity on the Manganese Content of Some of the Indigenous Grasses and Leafy Fodders.

P. C. SAWHNEY and N. D. KEHAR, Izatnagar.

The manganese content of 17 grasses cut in August, September and October at four different stages of maturity was determined. In majority of the cases continuous decrease with the progress of maturity in the manganese content was noticed. In others a fall in the second and third cuts followed by a rise in the fourth cut was observed.

The manganese content of 18 tree leaves lopped in November, January and March was also determined. They were classified into three groups, depending on the manganese content. The first group of five, exhibited maximum manganese content in the month of November, the second group of six in the month of January and the third group of seven in the month of March.

39. The Manganese Content of Some of the Common Animal Feeds.

P. C. SAWHNEY and N. D. KEHAR, Izatnagar.

In view of the great importance of manganese in animal nutrition, a large number of samples of grasses, straws, grains and oil cakes were examined for their manganese content. The amount of manganese in as many as 60 samples of straws has been found to range between 18.37 and 86.1 parts per million of the dry matter with the exception of paddy straw which showed as high as 772 parts per million of the dry matter. Practically 50 per cent of these samples contained manganese below 50 parts per million of the dry matter. Grasses exhibited a range between 22.23 and 212.64 parts per million

of the dry matter. Nearly 33 per cent of these samples contained manganese below 50 parts per million of the dry matter. Twentythree concentrates including oil cakes, grains and seeds and their by-products exhibited a range between 27.33 and 153.47 parts per million on dry matter basis. 66 per cent of these concentrates contain manganese below 50 p. p.m., 5 per cent show an adequate range of 50-60 p. p. m. according to Wisconsin workers and 29 per cent are high in manganese.

General Physiology

40. The problem of the structure of the vowels and the consonants in human speech.*

C. R. SANKARAN, Poona.

The paper gives a brief resume of the earlier approaches to the problem. The construction of α -phoneme theory is shown. The *toolvalue* of the α -phoneme theory indicating its derivative consequences is discussed. The α -phoneme theory is demonstrated to be purely a mathematical concept.

41. Climatic factors in relation to Comfort in tropics-A preliminary Report.

G. SANKARAN and M. N. RAO, Calcutta.

The subjective feeling of Comfort is based on the reaction of the human organism to the environment, physical as well as psychological. Climatic conditions comprise in main the physical environment. In a tropical country like ours, climatic factors assume even a greater importance. The correlation of different climatic factors with Comfort in Calcutta is reported in this paper.

Comfort Votes and climatological data were collected twice a week continuously over a period of one year. Eight climatic factors

- (1) Dry Bulb Temperature
- (2) Effective Temperature
- (3) Dry Red Kata Rate of cooling
- (4) Wet Kata Rate of cooling
- (5) Relative Humidity
- (6) Air Velocity
- (7) Evaporative cooling
- (8) Dry Blue Kata Rate of cooling

were correlated with the 3930 Votes collected on a 13 point scale of Comfort.

The Dry Bulb Temperature and the effective temperature were the two that gave the maximum correlation.

42. Haematological studies at high altitude.

C. R. DAS GUPTA, and C. CHANDRASEKHAR, Calcutta.

Haematological studies were carried out on adult healthy residents at Gangtok, 5,900 ft. above sea level and at Kalimpong, 3,933 ft. above sea level.

Comparing the values of Indian males and females of plains and hills.

Indian males in the hills have higher values for haemoglobin, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration than Indian males in the plains. No difference emerges in red cell count and in mean corpuscular volume between the residents in the hills and in the plains.

Just as in the case of males, Indian females in the hills have higher values for haemoglobin, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration than Indian females in the plains. Also, as in the males, there is no difference in the mean corpuscular volume between the residents in the hills and in the plain. But unlike in the males, in the red cells, the Indian females at Kalimpong have a slightly but not significantly higher values while the Indian females at Gangtok have significantly higher values than the residents in Calcutta.

*An investigation carried out with the generous grants from the Bombay University.

43. Synthesis of acetylcholine in the small intestine by adrenaline.

M. L. CHAKRAVARTY, Calcutta.

It has been recorded by previous workers that synthesis of acetylcholine by adrenaline takes place in some living tissues as well as in the dead. No work appears to have been done if this occurs in the gut. The subject has a great clinical significance because if synthesis takes place then the whole outlook of treating cases of haematemesis or hypermotility of the digestive tube with adrenaline has to be changed. Adrenaline came into the therapy for such malady because of its sympathomimetic action. Sympathetic being an inhibitory nerve adrenaline has been in use to inhibit the movement. It has been found in the course of experiments on the isolated small intestine of rabbit that when adrenaline was added under certain conditions, the gut showed stimulation resembling the stimulation when acetylcholine was added to the bath. The dominant inhibitory effect of adrenaline on the gut was there, nevertheless because of the formation of acetylcholine the gut showed stimulation. Hence when the gut was in contact with adrenaline, the stimulation was not abrupt nor it was so marked but when the adrenaline was washed away the stimulation was not only marked but also immediate. After a very minute dose of adrenaline the gut showed only a stimulation.

Production of acetylcholine after adrenaline gains support from the fact that stimulation was enhanced by eserine and abolished by atropine. The stimulation always took place in the fresh gut. Gut cooled for more than 48 hours in Tyrode's solution in the ice chest and a piece of gut fully nicotinised failed to show stimulation under similar conditions.

44. Urinary Proteose—A Secondary Endogenous Allergen?

J. C. RAY, and SACHINDRA NATH CHAUDHURI, Calcutta.

Oriel and Barbar detected a nitrogenous matter, which they called proteose-like substance, in the urine of allergic cases. They claimed that this substance contains the allergen to which the patient is sensitive and may be effectively utilised in the treatment by method of hyposensitization. With antigen-antibody reactions as the basis of the condition Urbach classified the allergic state as follows :-

(a) Exogenous allergy i.e., the allergen imported from outside the organism. It may be :-

(i) primary, exerting its effect as it is.

(ii) secondary, becoming allergen only after being altered in the system.

or (iii) Hapten or residual antigen acting with specific antibodies but not antigenic.

(b) Endogenous allergy i.e., the allergen is elaborated in the system of the organism.

This may be :-

(i) auto-endogenous, i. e. allergens manufactured by pervert tissues, they may be primary (directly from diseased tissues), secondary (from allergised tissues) or haptens (residual antigen).

or (ii) hetero-endogenous, source of allergens being bacterial metabolism in the system. Now what position, as allergen, Oriel's p-substance occupies in this system of classification has not been yet determined. Oriel's opinion that it contains the endogenous allergen has only been empirically supported by Urbach who considers it to be a secondary endogenous allergen, but his opinion has not been scientifically proved. The present paper will discuss this problem based on experimental observations (though of preliminary nature) in this laboratory.

45. Physiological Studies on the Blood of Domestic Animals.
Part 3. Lactating buffaloes.

C. V. RAO, V. N. MURTY and N. D. KEHAR, Izatnagar.

Blood samples of six buffaloes were subjected to morphological and chemical analysis at fortnightly intervals throughout their lactation period of about 9 months from the date of calving. The highest concentration of the morphological and chemical constituents, observed between the 4th and 6th week, has shown a gradual fall with lactation. During the last month of the lactation, all the blood constituents showed a steady rise.

46. Reversible nature of Changes in basal ganglia in Parkinsonism.

NAGENDRANATH DE, Calcutta.

Definite organic changes have been described in the basal ganglia as responsible for the syndrome known as Parkinsonism. It has been said that disease, degeneration or injury of the globus pallidus leads to rigidity and that of the substantia nigra to tremour. But it has been observed that (1) the course of Parkinsonism may be interrupted by a period of absolute remission by an attack of another disease supervening and that

- (2) administration or otherwise intake of some drugs and chemicals produce the syndrome which lasts only as long as the drug remains in the system above a threshold level.

These indicate that whatever changes are produced in the structure and function of the basal ganglia in these cases are reversible.

47. Mammary-Pharyngeal reflex.

S. N. MATHUR, Lucknow.

At a previous session of this section of the Science Congress I gave my observations regarding a gastro-skin reflex. It was shown that the body possesses a mechanism for conserving water for emergency purposes. This mechanism inhibits the perspiratory activity whenever stores of water reach a certain minimum even though the skin temperature may be unpleasantly high. Under such conditions, which prevail during summer, a reflex starts from the stomach after taking water which restarts sweating.

Present observations are on a related reflex which may be termed Mammary-Pharyngeal reflex. This is only present in lactating women. It starts from the nipple of the mammary gland as soon as the child starts sucking. It has been observed that as soon as the baby puts in the nipple in the mouth the mother feels dryness in her mouth and feels thirsty. This is felt even though the mother may not have felt thirst at all immediately before sucking. This is obviously a nature's mechanism to restore back water going to be lost through milk, in advance.

Miscellaneous

48. Influence of Proteolytic Enzymes upon the Ionic Adsorption of Diphtheria Antibodies.

M. M. BISWAS, Calcutta.

Conducto-metric titrations of diphtheria antitoxic serum have been carried out with N/1 sulphuric acid and N/1 sodium hydroxide. The antitoxin have also been subjected to a process of proteolytic digestion at the isoelectric point and titration curves of the digestion mixture drawn at start and after 48 hours. Corresponding pH values have also been recorded. The titration curves of the antitoxins under the various conditions definitely prove that pure antitoxins possess a superior adsorbability of H⁺ and other ions and the enzyme digestion process has got a marked influence on the nature of the antitoxins.

49. Microbiology of Figs during Drying.

C. P. NATARAJAN, C. N. CHARI and E. M. MRAK, California.

In California figs are ordinarily harvested from the ground when about two-thirds dry. Drying is completed on trays exposed to the sun. During this period yeast and mold population commonly increase in the fig to such an extent that spoilage occurs. This is particularly true in cool and foggy weather. Tests were conducted to determine the effect of counter current dehydration on the yeast population in figs. Maximum drying temperatures of 130 and 140 were chosen because in this range the maximum rate of drying is obtained without causing heat damage and subsequent discoloration of the fruit. Figs dehydrated at a maximum temperature of 130 showed a slight increase in yeast count during the first 2 hours then a gradual drop in the next 8 hours when they

were considered adequately dried. The temperature of the interior of the fruit as determined by thermocouple measurements reached that of the dry bulb of the dehydrator in 3 hours. Fruit dehydrated at a maximum temperature of 140 also showed a slight increase in yeast count during the first 2 hours of drying. This was followed by a gradual decline during the next 3 hours and a very sharp decline during the last 3 hours. The time required for the interior of the fig to reach dry bulb temperature was about 5 hours. In neither case were all yeasts killed. The average count of yeasts per fig for those dried at 130 was 10^7 at first, and 10^5 when dry after 10 hours. Those dehydrated at 140 dropped to 10^3 in 8 hours when the fruit was considered dry. Counts made on figs dried in the sun showed considerable increases. In view of this dehydration is recommended as a means of reducing yeast count and spoilage in figs.

50. The Cutler Test in Kala-azar.

N. K. CHAKRAVARTY and P. C. SEN GUPTA, Calcutta.

The test originally introduced for the diagnosis of Addison's disease was applied to a series of 53 cases of kala-azar and 12 controls. Besides the urinary chloride in the last four hours of the test period, the plasma chloride before and after the salt deprivation was also estimated. The maximum urinary chloride concentration in the control group of cases was 300 mgm per cent (as NaCl), the mean and standard deviation being 153.0 ± 85.2 mgm. per cent. In the kala-azar group of cases, 16 showed an excretion above 300 mgm per cent and the mean and standard deviation of the whole group was 262.7 ± 158.8 mgm per cent. Thus compared with the control group, 30.2 per cent cases of kala-azar gave a positive reaction. Also the percentage of positive reactions was 25 for early cases, 30 for moderately advanced cases and 33.3 per cent for the well developed cases of kala-azar. If we consider the results of the test in this series of 53 cases of kala-azar according to the standards laid down by Cutler, positive results were obtained in 17 per cent (9 cases), doubtful results in 39.6 per cent (21 cases), and negative results in 43.4 per cent (23 cases). It is probably more accurate to compare our results with the results obtained in our control.

The test was repeated in three patients with the administration of of desoxycorticosterone acetate (DOCA) during the test procedure. All the patients who had given a positive reaction with the Cutler test responded to DOCA by lowered chloride excretion. The chloride concentration was sufficiently reduced in two cases to indicate a negative reaction and in the other it still persisted as positive.

The high proportion of positive reactions (33.3%) in the well-developed cases of kala-azar indicates that there is an involvement of the suprarenal cortex frequently in the course of the disease. The pigmentation of kala-azar, that in advanced cases is somewhat similar to that seen in Addison's disease, can thus be explained on the basis of adrenal hypofunction. Low blood pressure, lack of muscular tone, emaciation and asthenia may possibly be due to the adrenocortical insufficiency.

51. Creatinuria Index in Lathyrism.

M. N. RUDRA, Darbhanga.

Creatinuria Index has been determined in six lathyrism patients of 15 days to 3 months duration. The values obtained varied from 1.03 to 1.24.

52. A Case of 'dropsy' in a fresh water fish, *Ophicephalus striatus* Bl.

M. RAHIMULLA, Hyderabad-Deccan.

A female fish was found in the month of July 1946 in the Hosainsagar reservoir, floating upsidedown, in a living condition. The abdomen was full of fluid; the stomach and intestine were empty showing that the fish had stopped feeding. The liver was of a yellowish colour and in an unhealthy condition. The gonads were shrivelled and a few unhealthy eggs were present, although it was the breeding season. The fish was not healthy as shown by the ruffled condition of the scale on the abdomen and the sides.

The author has communicated this paper to this section only because the medical authorities assembled there will be able to throw some light on this disease. Is it in any way similar to the one found in human beings?

53. Vitamin C and Sleep:

S. N. MATHUR, Lucknow

It has been observed that Vitamin C is a potent factor in causing sleeplessness by its absence and bringing about sleep when given in such conditions. These conclusions are based on observations made on human beings and have been so convincing that it was thought desirable to communicate. First observation was made on a neighbour who had not slept for a fortnight, as he told me. From his dietetic history it was concluded that there was complete lack of Vitamin C from his diet extending to over several months and lately there was almost complete lack of all other vitamins also. For over one month he was living on sugo bread and meat soup only. He had several dozen proscription in his possession exhausting practically all the sudorific and hypnotic drugs taken one after the other. He had reached a stage when no drug could induce sleep. On my advice he took two tumblerful of carrot juice. He reported next day that soon after taking the juice he slept like a log and had not known a sounder sleep in his life. Similar report was given by a doctor friend of mine whom I gave about 100 mg. of ascorbic acid. Since then observations have been extended our self, my family, and relatives and friends. Latest observation is on an infant 5 months old who when ever he misses his does of vitamin C, either as ascorbic acid or fruit juice sleeps badly. Sleep is speedily brought about by giving him a little extra vitamin C.

As regard the mode of action no explanation can be offered at this stage. Two theories can however be suggested. One, that, as in scorbutic condition, it prevents excessive diffusions of blood which might cause sleeplessness, the second, that it is some way, as esserin for example, potentiates the action of parasympathetic part of nervous system either directly or indirectly

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